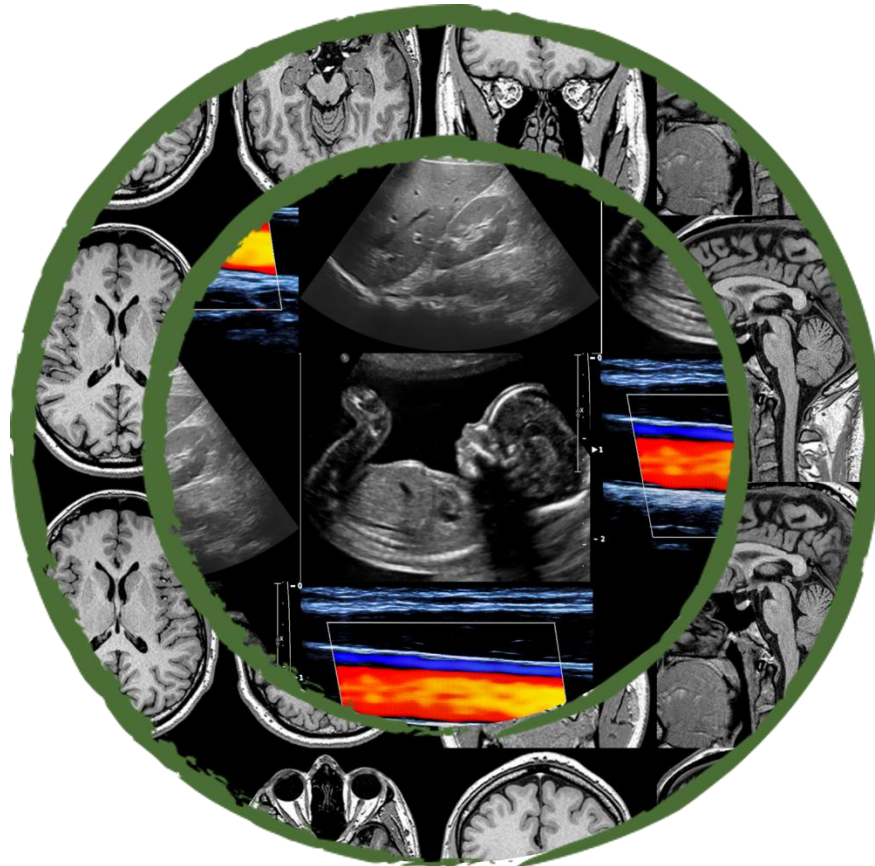




Clinical Magnetic Resonance Imaging and Ultrasonography Joint Training Manual

(Master of Science in Radiologic Sciences Program)

2024/2025



Radiologic Sciences Department
Faculty of Applied Medical Sciences
King Abdulaziz University

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Introduction to the Program

Program Overview

This Master of Science in Radiologic Sciences program at King Abdulaziz University has made a name for itself as a pioneer in training the upcoming generation of medical imaging and radiologic sciences experts. The program's main goal is to align with the institution's fundamental vision by strategically focusing on essential principles like clinical practice, novel research, and leadership in the healthcare sector. This is accomplished by providing students with a strong and dynamic curriculum that will enable them to succeed. Ensuring that these postgraduate students are practicing in excellence and aligned with leading global standards in radiologic sciences. Thus, this program aims to give students a thorough education that fosters professionalism and lifelong learning while preparing them for high-level work in medical imaging and radiation sciences as capable, compassionate team members.

Purpose of the Training Manual

This handbook serves as a practical and instructional guide to support the delivery of clinical magnetic resonance imaging (MRI) and ultrasonography (US) training in alignment with the program's learning outcomes. It aims to standardize the training process, ensuring consistency across trainers and trainees. The program integrates academic instruction with comprehensive clinical training through compulsory clinical MRI and US courses among the MSc in Radiologic Sciences curriculum.

This manual provides clear expectations and structured guidance, enhancing the student learning experience while supporting course instructors and trainers in delivering high-quality clinical education. It outlines the essential structure, objectives, and methodologies to ensure students are well-prepared both theoretically and clinically.

Outlines of training goals

The clinical training in MRI and US aims to prepare students as proficient MRI/US technologists through comprehensive development across three key learning domains: **cognitive** (knowledge), **psychomotor** (skills), and **affective** (professional behavior).

Target audience

This Clinical Training Manual is designed to support all key stakeholders involved in the clinical education process for MRI and US training. It is intended for:

- 
- a. Students who are enrolled in the Master's program in Radiologic Sciences and are beginning their clinical rotations, during which they apply theoretical knowledge in real clinical settings.
 - b. Clinical Instructors or Trainers responsible for supervising and guiding student performance in hospitals or imaging centers.
 - c. Faculty Members and Course Coordinators overseeing the clinical training process, student evaluations, and ensuring alignment with academic and professional standards.



Magnetic Resonance Imaging (MRI) Track

Expected Learning Outcomes

Upon completing the clinical training in RAD626 and RAD627, students will be able to achieve the following course learning outcomes (CLOs) across three main domains:

Course	Knowledge and understanding		Skills			Values, autonomy, and responsibility		
	K1	K2	S1	S2	S3	V1	V2	V3
626	Define scientific knowledge in magnetic resonance imaging machine preparation	Identify MR safety precautions and protocols of head, neck, spine, upper musculoskeletal, and lower musculoskeletal.	Apply the appropriate MRI techniques and protocols of head, neck, spine, upper musculoskeletal, and lower musculoskeletal	Apply the appropriate MRI techniques and protocols of head, neck, spine, upper musculoskeletal, and lower musculoskeletal	Interpret MRI images including anatomical and pathological characteristics of head, neck, spine, upper musculoskeletal, and lower musculoskeletal.	Practice the acquired knowledge with colleagues and technicians	Practice the acquired knowledge with colleagues and technicians	Perform MRI procedures and acquire data of head, neck, spine, upper musculoskeletal, and lower musculoskeletal
	Describe advanced imaging techniques and MRI parameters in image formation			Evaluate the process affecting MR image quality.			Perform MRI procedures and acquire data of head, neck, spine, upper musculoskeletal, and lower musculoskeletal.	
627	Define scientific knowledge in magnetic resonance imaging machine preparation	Identify MR safety precautions and protocols of abdomen, pelvis, breast, cardiac, and angiography	Apply the appropriate MRI techniques and protocols of abdomen, pelvis, breast, cardiac, and angiography	Apply the appropriate MRI techniques and protocols of abdomen, pelvis, breast, cardiac, and angiography	Interpret MRI images including anatomical and pathological characteristics of abdomen, pelvis, breast, cardiac, and angiography	Practice the acquired knowledge with colleagues and technicians	Practice the acquired knowledge with colleagues and technicians	Perform MRI procedures and acquire data of abdomen, pelvis, breast, cardiac, and angiography
	Describe advanced imaging techniques and MRI parameters in image formation			Evaluate the process affecting MR image quality.			Perform MRI procedures and acquire data of abdomen, pelvis, breast, cardiac, and angiography	



Training Timeline and Schedule

Course Duration

Clinical training is integrated into two dedicated courses, each carrying 2 credit hours: **RAD626** and **RAD627**. These courses are delivered sequentially over the third and fourth academic levels, respectively, with each spanning a full 16-week semester.

- **RAD626** is conducted in the first semester of the second year.
- **RAD627** follows in the second semester of the same academic year.

Each course includes a total of 90 contact hours, encompassing supervised clinical training sessions, case study presentations and clinical performance assessments.

Weekly Schedule

1) Course RAD626 (**MRI Clinical Practice I: Head, Neck, Spine, Musculoskeletal**)

Week	Activity	Contact Hours
1	Clinical training in Head MRI	6
2	Clinical training in Head MRI	6
3	Clinical training in Head MRI	6
4	Clinical training in Head MRI	6
5	Case Study Presentation Head	6
6	Clinical training in Neck MRI	6
7	Clinical training in Neck MRI	6
8	Case Study Presentation Neck	6
9	Clinical training in Spine MRI	6
10	Case Study Presentation Spine	6
11	Clinical training in Upper Musculoskeletal MRI	6
12	Case Study Presentation Upper Musculoskeletal	6
13	Clinical training in Lower Musculoskeletal MRI	6
14	Case Study Presentation Lower Musculoskeletal	6
15	Revision	6
16	Practical Exam	NA



2) Course RAD627 (**MRI Clinical Practice II: Chest, Cardiac, Breast, Abdomen, Pelvis, Angiography**)

Week	Activity	Contact Hours
1	Clinical training in Chest MRI	6
2	Clinical training in Chest MRI	6
3	Case Study Presentation in Chest MRI	6
4	Clinical training in Cardiac MRI	6
5	Case Study Presentation in Cardiac MRI	6
6	Clinical training in Breast MRI	6
7	Case Study Presentation in Breast MRI	6
8	Clinical training in Abdomen MRI	6
9	Clinical training in Abdomen MRI	6
10	Case Study Presentation in Abdomen MRI	6
11	Clinical training in Upper Female and Male Pelvis MRI	6
12	Case Study Presentation in Female and Male Pelvis MRI	6
13	Clinical training in MRI Angiography	6
14	Case Study Presentation in MRI Angiography	6
15	Revision	6
16	Practical Exam	NA

Final Clinical Exam Schedule:

While the final clinical exam is generally held in the period between the end of week 15 and week 16, the exact timing is determined by the department's schedule.



Breakdown of MRI Training Modules

Course 626 (MRI Clinical Practice I: Head, Neck, Spine, Musculoskeletal)

Module: Head I – Brain & Skull

- **Content:** In this module, students cover these topics: brain, skull, temporal lobes, internal auditory meatus, pituitary fossa, orbits and paranasal sinuses.
- **Objectives:** Understand MRI protocols for brain/skull; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Head I – Brain & Skull

- **Content:** In this module, students cover these topics: pharynx, larynx, thyroid, parathyroid glands, salivary glands and temporomandibular joints.
- **Objectives:** Understand MRI protocols for Neck; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Spine MRI

- **Content:** In this module, students cover these topics: cervical, thoracic, and lumbar spine.
- **Objectives:** Understand MRI protocols for Spine; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Upper Musculoskeletal MRI

- **Content:** In this module, students cover these topics: shoulder, humerus, elbow, forearm, wrist and hand.
- **Objectives:** Understand MRI protocols for Upper Musculoskeletal; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.



Module: Lower Musculoskeletal MRI

- **Content:** In this module, students cover these topics: hips, femur, knee, tibia and fibula, ankle and foot.
- **Objectives:** Understand MRI protocols for Lower Musculoskeletal; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Course 627 (MRI Clinical Practice II: Chest, Cardiac, Breast, Abdomen, Pelvis, Angiography)

Module: Head I – Chest

- **Content:** In this module, students cover these topics: lungs, mediastinum and thymus.
- **Objectives:** Understand MRI protocols for Chest; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Head I – Cardiac

- **Content:** In this module, students cover these topics: heart and great vessels
- **Objectives:** Understand MRI protocols for cardiac; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Breast MRI

- **Content:** In this module, students cover these topics: breast, axilla and brachial plexus.
- **Objectives:** Understand MRI protocols for breast; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.



Module: Abdomen MRI

- **Content:** In this module, students cover these topics: liver and biliary system, kidneys and adrenal glands, pancreas.
- **Objectives:** Understand MRI protocols for abdomen; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: Female and Male Pelvis MRI

- **Content:** In this module, students cover these topics: male pelvis, female pelvis, obstetrics.
- **Objectives:** Understand MRI protocols for pelvis; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.

Module: MRI Angiography

- **Content:** In this module, students cover these topics: head, neck, chest, abdomen, lower extremities vascular imaging.
- **Objectives:** Understand MRI protocols for angiography; identify anatomical structures. Also, gain confidence in protocol selection and pathology recognition
- **Instructional Methods:** Observation, Supervised scanning, hands-on coil placement and scan protocol setup. Also, discussions with supervising practitioners on clinical cases.



Roles and Responsibilities of Trainers

MRI clinical trainers are essential facilitators in the clinical education of master's students. Their primary responsibilities include:

- **Supervision and Clinical Instruction:** Provide direct and indirect supervision during clinical practice sessions in MRI departments, following RAD 626 and RAD 627 course requirements.
- **Demonstrating Best Practices:** Model correct MRI techniques, including machine preparation, patient positioning, protocol selection, and troubleshooting image quality.
- **Curriculum Integration:** Ensure that clinical teaching aligns with the program's mapped Program Learning Outcomes (PLOs), particularly in knowledge, skills, and values domains.
- **Safety Leadership:** Enforce MRI safety protocols rigorously, educating students on patient and equipment safety at all stages.
- **Feedback and Competency Assessment:** Continuously assess student performance using logbooks, case study presentations, and final clinical exams, providing constructive feedback.
- **Clinical Coordination:** document students' attendance and disciplines and coordinate with clinical site supervisors.
- **Professional Role Modeling:** Exhibit professionalism, critical thinking, communication skills, and ethical standards in daily interactions.
- **Mentorship and Motivation:** Inspire students to pursue excellence, research, leadership roles, and ongoing learning within the radiologic sciences field. They also address any issues related to student performance in clinical training.



Roles and Responsibilities of Participants (Students)

Students in the radiologic sciences master's program (MRI track) are expected to take active ownership of their learning experience. Key responsibilities include:

- **Professional Behavior:** Demonstrate punctuality, responsibility, patient confidentiality, and ethical standards as outlined in program policies.
- **Active Clinical Engagement:** Participate proactively in clinical training sessions covering head, neck, spine, musculoskeletal, abdomen, pelvis, breast, cardiac, and angiography imaging.
- **Preparation and Self-Study:** Prepare for clinical rotations by reviewing assigned reading, MRI protocols, and safety standards.
- **Documentation and Reflection:** Accurately complete logbooks, clinical evaluations, and case study presentations to document clinical experiences and self-assess progress.
- **Team Collaboration:** Work effectively with peers, technologists, and radiologists, demonstrating leadership, communication, and teamwork.
- **Commitment to Improvement:** Reflect on feedback, set learning goals, and demonstrate continuous self-improvement toward mastering cognitive, psychomotor, and affective domains.
- **Research and Critical Thinking:** Apply research methods, critical appraisal skills, and innovation in clinical problem-solving, following the program's emphasis on research integration.



Recommended Teaching Strategies

To optimize clinical education and align with the best practices based on program specifications, the following teaching strategies are recommended:

- **Case-Based Learning:** Utilize clinical case discussions to integrate theoretical knowledge with practical application across MRI specialties.
- **Progressive Skill Development:** Begin with observation, move to assisted procedures, and gradually foster independent practice under indirect supervision.
- **Formative and Summative Assessments:** Apply continuous assessments (logbooks, practical exams, case presentations) and summative evaluations (final clinical exams) to measure student progress.
- **Reflective Learning:** Encourage students to regularly reflect on clinical experiences through structured assignments or learning portfolios.
- **Interprofessional Collaboration:** Promote interactions between students, radiologists, nurses, and technologists to enhance teamwork and communication skills.
- **Research-Integrated Learning:** Foster critical thinking by engaging students in case-based research, evidence-based practice discussions, and encouraging participation in innovation competitions.



Assessment methods used to evaluate trainee performance

To assess trainees' performance and follow their progress and achievement of the intended learning outcomes from the clinical courses and the program, different pre-defined methods and scheduled tasks, as described below, are being implemented.

- **Logbook:** To assess trainees' adherence and help them keep track of their clinical visits, a logbook of attended cases is being used. Towards the end of the semester, the logbooks are collected and evaluated by the course coordinator.
- **Case discussions, presentations, and report:** Trainees are expected to clearly and professionally discuss different cases in relevance to the course's topics. The trainees' conduct is assessed and scored following pre-determined rubrics by the course coordinator and instructors. The selected cases should cover a review of related patient history and clinical presentation, detailed description of used MRI techniques, sequences, acquired images, and findings while observing anatomy and pathology and any related technical modifications. Trainees are also expected to integrate relevant scientific literature to support their discussion. Having multiple case study discussions throughout the semester helps in assessing trainees' gradual build of confidence and cumulative knowledge from their hospital visits.
- **Clinical and Final Assessment:** Trainees undergo a case scenario-based assessment which measures their ability to perform MRI exams starting from communicating with patients and initiating exams until the end of exams. The assessment includes a Rubric-based evaluation, which covers aspects such as appropriate protocol selection and patient positioning, sequence planning, and checking images and differentiating anatomical and pathological characteristics on them.



Integrated Support materials

(such as exercises, case studies, handouts, and references should be integrated within each module)

As part of the curriculum, the clinical courses are preceded with pre-requisite courses that cover MRI image acquisition and optimization techniques as well as the different MRI sequences, protocols and procedures of the various body parts. This should equip the trainees with the basic knowledge and understanding needed for their clinical practices. Additionally, trainees are provided at the beginning of the course with a syllabus that includes a list of the relevant textbooks and other resources needed for the courses so to enhance their clinical experience. Throughout the course, trainees are required to present and discuss different case studies, which should also enrich their acquired knowledge.



Administrative and logistical information to guide smooth implementation

At the beginning of the semester, the trainees are provided with a clear plan for the conduct of the course throughout the semester including the required work to be submitted by the trainees as well as relevant textbooks and online resources. The trainees' rotations and clinical assignments are also scheduled and provided to them.

The clinical courses run for a full semester on a weekly basis, which are conducted at King Abdulaziz University Hospital. The hospital has four MRI scanners with different field strengths (two of 3 Tesla and two of 1.5 Tesla), which are connected to a PACS system that allows reviewing and assessing acquired images. The MRI department in the hospital is also equipped with the necessary measures to ensure safety precautions are in place. To ensure safe and professional practices by the trainees, the clinical courses have pre-requisite courses that teach trainees about different aspects of MRI equipment and workflow including safety. In the hospital, trainees are mentored by and trained under qualified hospital staff. Trainees also have regular meetings with courses instructors and can reach out to them through their contact emails and during office hours, which are all provided to the trainees at the beginning of the program.





Ultrasound (US) Track

Expected Learning Outcomes

Upon completing the clinical training in RAD644 and RAD647, students will be able to achieve the following course learning outcomes (CLOs) across three main domains:

Course	Knowledge and understanding	Skills		Values, autonomy, and responsibility		
	K2	S1	S2	V1	V2	V3
644	Describe anatomical and pathological appearance in ultrasound images.	Implement appropriate ultrasound imaging techniques of abdomen and pelvis, obstetrics and gynecology, and small parts in clinical practice.	Identify sonographic findings of abdomen and pelvis, obstetrics and gynecology, and small parts in clinical practice.	Demonstrate professional interaction skills with staff to improve ultrasound practice.	Demonstrate professional interaction skills with staff to improve ultrasound practice.	Provide patient care, privacy and confidentiality.
		Discuss ultrasound diagnostic criteria of abdomen and pelvis, obstetrics and gynecology, and small parts in clinical practice.	Implement appropriate ultrasound imaging techniques of abdomen and pelvis, obstetrics and gynecology, and small parts in clinical practice.		Perform MRI procedures and acquire data of head, neck, spine, upper musculoskeletal, and lower musculoskeletal.	
			Discuss ultrasound diagnostic criteria of abdomen and pelvis, obstetrics and gynecology, and small parts in clinical practice.			
647	Describe anatomical and pathological appearance in ultrasound images of CVS, MSK and pediatrics	Implement appropriate US imaging techniques CVS, MSK and pediatrics in clinical practice	Identify sonographic findings of CVS, MSK and pediatrics in clinical practice.	Demonstrate professional interaction skills with staff to improve ultrasound practice.	Demonstrate professional interaction skills with staff to improve ultrasound practice.	Provide patient care, privacy and confidentiality.
		Discuss ultrasound diagnostic criteria of CVS, MSK and pediatrics.	Implement appropriate US imaging techniques CVS, MSK and pediatrics in clinical practice			
			Discuss ultrasound diagnostic criteria of CVS, MSK and pediatrics.			



Training Timeline and Schedule

Course Duration

Clinical training is integrated into two dedicated courses, each carrying 2 credit hours: **RAD644** and **RAD647**. These courses are delivered sequentially over the third and fourth academic levels, respectively, with each spanning a full 16-week semester.

- **RAD644** is conducted in the first semester of the second year.
- **RAD647** follows in the second semester of the same academic year.

Each course includes a total of 90 contact hours, encompassing supervised clinical training sessions, case study presentations and clinical performance assessments. Clinical courses also include weekly clinical rotations, theoretical sessions, and assessments.

Weekly Schedule

1) Course RAD644 (Clinical Ultrasonography I)

Week	Activity	Contact Hours
1	Clinical Training	6
2	Clinical Training	6
3	Clinical Training	6
4	Clinical Training	6
5	Case Study Presentation I (Abdomen and Pelvis)	6
6	Clinical Assessment I	6
7	Clinical Training	6
8	Clinical Training	6
9	Clinical Training	6
10	Case Study Presentation II (Small Parts)	6
11	Clinical Assessment II	6
12	Clinical Training	6
13	Clinical Training	6
14	Case Study Presentation III (Obstetrics and Gynecology)	6
15	Clinical Assessment III	6



2) Course RAD647 (Clinical Ultrasonography II)

Week	Activity	Contact Hours
1	Clinical Training	6
2	Clinical Training	6
3	Clinical Training	6
4	Clinical Training	6
5	Case Study Presentation I (Vascular)	6
6	Clinical Assessment I	6
7	Clinical Training	6
8	Clinical Training	6
9	Clinical Training	6
10	Case Study Presentation II (Echocardiography)	6
11	Clinical Assessment II	6
12	Clinical Training	6
13	Clinical Training	6
14	Case Study Presentation III (MSK & Pediatrics)	6
15	Clinical Assessment III	6



Breakdown of US Training Modules

Course 644 (Clinical Ultrasonography I)

- **Content:** This course is designed to assign students to a clinical education center to practice ultrasound imaging under the supervision of a qualified practitioner. The course is structured into three major clinical training modules, each focusing on specific ultrasound specialties:
 - **Module 1:** Abdomen and Pelvis Imaging
 - **Module 2:** Small Parts Imaging
 - **Module 3:** Obstetrics and Gynecology Imaging
- **Objectives:** The course's main objective is to provide high quality clinical training for safe and accurate ultrasound examinations.
- **Instructional Methods:** Lectures, hands-on sessions, case studies, simulations.

Course 647 (Clinical Ultrasonography II)

- **Content:** This course is designed to assign students to a clinical education center to practice ultrasound imaging under the supervision of a qualified practitioner. The course is structured into three major clinical training modules, each focusing on specific ultrasound specialties:
 - **Module 1:** Vascular Imaging
 - **Module 2:** Echocardiography
 - **Module 3:** Musculoskeletal and pediatrics Imaging
- **Objectives:** The course's main objective is to provide high quality clinical training for safe and accurate ultrasound examinations.
- **Instructional Methods:** Lectures, hands-on sessions, case studies, simulations.



Roles and Responsibilities of Trainers

US clinical trainers are essential facilitators in the clinical education of master's students. Their primary responsibilities include:

- **Supervision and Clinical Instruction:** Provide direct and indirect supervision during clinical practice sessions in US departments.
- **Demonstrating Best Practices:** demonstrate scanning techniques, including machine preparation, patient positioning and assessment of image quality.
- **Curriculum Integration:** Ensure that clinical teaching aligns with the program's mapped Program Learning Outcomes (PLOs), particularly in knowledge, skills, and values domains.
- **Feedback and Competency Assessment:** Continuously assess student performance by providing structured feedback through performance evaluation, guided case discussions, and clinical exams.
- **Clinical Coordination:** document students' attendance and disciplines and coordinate with clinical site supervisors.
- **Professional Role Modeling:** Exhibit professionalism, critical thinking, communication skills, and ethical standards in daily interactions.
- **Mentorship and Motivation:** Inspire students to pursue excellence, research, leadership roles, and ongoing learning within the radiologic sciences field. They also address any issues related to student performance in clinical training.



Roles and Responsibilities of Participants (Students)

Students in the radiologic sciences master's program (US Track) are expected to take active ownership of their learning experience. Key responsibilities include:

- **Professional Behavior:** Demonstrate punctuality, responsibility, patient confidentiality, and ethical standards as outlined in program policies.
- **Active Clinical Engagement:** Participate proactively in clinical training sessions covered in clinical ultrasonography courses.
- **Documentation and Reflection:** Accurately complete logbooks, clinical evaluations, and case study presentations to document clinical experiences and self-assess progress.
- **Team Collaboration:** Work effectively with peers, technologists, and radiologists, demonstrating leadership, communication, and teamwork.
- **Commitment to Improvement:** Reflect on feedback, set learning goals, and demonstrate continuous self-improvement toward mastering cognitive, psychomotor, and affective domains.
- **Research and Critical Thinking:** Apply research methods, critical appraisal skills, and innovation in clinical problem-solving, following the program's emphasis on research integration.



Recommended Teaching Strategies

The Master of Sciences in Radiologic Sciences (US track) program employs a variety of teaching strategies to ensure comprehensive learning and skill development:

- **Case-Based Learning:** Students analyze and discuss real patient cases to enhance diagnostic reasoning and problem-solving skills.
- **Hands-On Training:** Supervised practical sessions allow students to apply theoretical knowledge in real-world scenarios, using ultrasound equipment to perform examinations.
- **Simulation Training:** Virtual or mannequin-based simulations provide a risk-free environment for practicing complex procedures.
- **Clinical Rotations:** Students rotate through specialized departments (e.g., abdominal, vascular, obstetrics) to gain diverse experience under the guidance of clinical trainers.
- **Peer Learning:** Collaborative activities, such as group discussions and peer feedback sessions, foster teamwork and knowledge sharing.
- **Mentorship:** One-on-one guidance from experienced clinicians helps students refine techniques and professional behaviours.
- **Research-Integrated Learning:** Foster critical thinking by engaging students in case-based research, evidence-based practice discussions, and encouraging participation in innovation competitions.



Assessment methods used to evaluate trainee performance

To assess students' performance and follow their progress and achievement of the intended learning outcomes from the clinical courses and the program, different pre-defined methods and scheduled tasks, as described below, are being implemented.

- **Clinical Competency Evaluations:** Trainers assess students' technical skills during hands-on sessions using standardized checklists.
- **Logbook documentation:** Students maintain records of completed procedures, reviewed cases, and trainer feedback.
- **Case-based discussions and presentations:** Trainees are expected to clearly and professionally discuss different cases in relevance to the course's topics. The trainees' conduct is assessed and scored following pre-determined rubrics by the course coordinator and instructors. They present and defend their findings from real or simulated cases to demonstrate diagnostic and communication skills.
- **Practical Examinations:** Objective Structured Clinical Examinations (OSCEs) to evaluate image acquisition, interpretation, and reporting abilities.
- **Research Assignments:** Critical appraisal of ultrasound-related literature or small-scale research projects.
- **Professionalism Assessments:** Evaluations of communication, ethics, and teamwork during clinical interactions.



Integrated Support Materials

To supplement learning, the program provides:

- **Textbooks and Journals:** Access to key resources, peer-reviewed articles, and institutional libraries.
- **Digital Tools:** Online platforms for lecture notes, video tutorials, and interactive quizzes.
- **Image Repositories:** Databases of normal and pathological ultrasound images for self-study.
- **Protocol Manuals:** Standardized guidelines for examination techniques and reporting.
- **Simulation Software:** Virtual ultrasound platforms for practice outside clinical hours.
- **Clinical Logbooks:** Templates for tracking procedures, competencies, and feedback.
- **Research Guides:** Frameworks for thesis work and evidence-based practice projects.
- **Rubric** - Rubric for clinical assessment and for case study presentation assessment.



Administrative and logistical information to guide smooth implementation

At the beginning of the semester, the trainees are provided with a clear plan for the conduct of the course throughout the semester including the required work to be submitted by the trainees as well as relevant textbooks and online resources. The students' rotations and clinical assignments are also scheduled and provided to them. Students are assigned to accredited clinical site (King Abdulaziz University Hospital) through formal agreements coordinated by the department, based on site capacity and specialty focus. Prior to placement, students must provide proof of health clearance, immunization, and liability insurance. Any issues during placement must be reported to the course and clinical coordinator to ensure timely support. The department maintains ongoing communication with clinical sites to ensure alignment with training standards. Particularly, administrative and logistical information can be followed with:

- **Course Coordinator:** Managed by the Radiologic Sciences Department at KAU.
- **Clinical Sites:** Training occurs at KAU Hospital and affiliated centers. Schedules are distributed at the semester start.
- **Attendance Policy:** Mandatory 90% attendance for clinical sessions. Absences require documentation.
- **Equipment:** Students receive training on five ultrasound machines (e.g., GE, Philips) and PACS systems.
- **Safety Protocols:** Compliance with infection control, patient privacy (HIPAA equivalents), and equipment safety guidelines.
- **Grievance Process:** Issues are escalated to course coordinators and resolved per university policies.
- **Certification:** Course completion requires passing all assessments.





Appendix

Case Study Rubric



RAD627_Rubric for Evaluation of Clinical Case Study Discussion/Presentation

RAD627_MRI_Clinical	Presenter	Topic	Instructor			
CRITERIA	Quality					
	Excellent (5-4)	Good (3)	Needs Improvement (2)	Inadequate (1)	Not Presented (0)	Score
The Chosen case study, clinical history and Indication for MRI examination (An interesting case study, Pt. demographic and indication, medical history, previous radiological examination)	A complete and detailed documentation of all elements related to the presented clinical case	Detailed documentation of a majority of the elements with one element missing related to the presented clinical case	Incomplete documentation with two elements missing related to the presented clinical case	Incomplete documentation with more than two elements missing related to the presented clinical case	-	
MRI Procedure& Protocol (Room and Pt. preparation and instruction, Pt. position and coil used, laser centering, Explanation of the MRI protocol and specific sequences for that pathology, advanced techniques which used in this case.)	Explained a complete MRI imaging protocol/method of the presented clinical case, present the used advanced techniques	Explained and complete MRI protocol/method of presented clinical case with one missing element	Explained incomplete MRI protocol/method with more than one missing elements	Imaging protocol/method not explained	-	
MRI Images and Findings and any suggested improvement (Images of all used sequences, and good demonstration of image and pathology, presentation of imaging findings and measurements. Able to describe the appearances of structures related to pathological and non-pathological conditions, , Use of contrast media, advance protocols it might help the examination from students' point of view)	A Complete and detailed presentation of image findings related to the presented clinical case, advance protocols it might help the examination from students' point of view with references	Most of the image findings were presented with one missing finding related to the presented clinical case.	Some of the image findings were presented with two missing findings related to the presented clinical case.	Majority of study findings not presented with more than two missing elements related to the presented clinical case.		
Presentation (Organized presentation, illustrations, photographs, diagrams, and/or animation, time management and answer questions related to the presented case)	Holds attention of audience with well-organized presentation. Able to answer questions. Complete presentation within the timeframe	Speaks with satisfactory volume with no emphasis on key points. Unable to answer one question. Presentation extended beyond timeframe within +/-2 minutes	Speaks with low volume with little enthusiasm. Unable to answer two questions. Presentation extended beyond timeframe within +/-3 minutes	Shows no interest in topic. Unable to answer more than two questions. Presentation extended beyond timeframe within +/-4 minutes		
Total points						

Note: Presentation time: 10 -12 mins **followed by Discussion:** 5-10 min

Clinical Continuous Assessment Rubric



MRI Clinical Practice (II) (RAD 627)
Clinical continues assessment Rubric

Date: / / 2023

Student Name	MRI Case/s

Category	Evaluation criteria	Score	
		Maximum	Awarded
Professionalism	Communicating with patients and colleagues, following hospital guide, uniform, appearance	0.5	
Preparation	Appropriate patient preparation for MRI scan including safety and the room's preparation	1	
Positioning	Right and comfortable positioning and clear instructions to the patients	1.5	
Scanning	Ability to register the patient and start the procedure and choose the appropriate protocol based on patient clinical indication	1.5	
	Right planning for all sequences and evaluate the process affecting MR image quality.	2	
	Analyse and interpret MRI images and differentiate anatomical and pathological characteristics.	1.5	
Ending the exam	Ending the exam, on scanner and on computer. From the last sequences until sending the images to PACS	1	
General questions	The investigator will ask, questions related the MRI Ability to answer questions.	1	
<i>Total</i>		10	

Instructor Name and Comments:

Clinical Logbook (MRI)

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FILED EXPERIENCE LOG BOOK

Student Name		Student ID	
Year/Level		Semester	
Course	MRI CLINICAL PRACTICE II	Code	RAD627
Supervisor			

[Dr. SADDIG JASTANIAH, 2018, Dr. Njoud Aldhary, 2020]

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Used sequences and the specific sequence of the protocol	
The area of coverage on the planning image and the slice alignment on each plan	

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MRI Clinical Practice (II)

RAD627

SN/Date	Case #	/ / 2022	
Patient Demographic Data	Patient ID	Gender	Age
Clinical Indications Data			
Body part under examination and exam name			
Patient & Body part position			
Patient position			
Used Coil			
On MRI console			
Protocol name			
Contrast media name and dose if it is used			

[Dr. SADDIG JASTANIAH, 2018, Dr. Njoud Aldhary, 2020]

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Observations & Remarks	
Student Signature	Instructor Signature

[Dr. SADDIG JASTANIAH, 2018, Dr. Njoud Aldhary, 2020]

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Clinical Logbook (US)

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LOGBOOK FOR CLINICAL CASES

Student Name		Student ID	
Year/Level		Semester	
Course	CLINICAL ultrasonography II	Code	RAD647
Supervisor			


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CLINICAL ultrasonography II
RAD647

SN/Date	Case #		/ / 2024
Patient Demographic Data	Patient ID	Gender	Age
Clinical Indications Data			
Body part under examination and exam name			
Patient & protocol position			
Patient position			
Used probe			
Pt. preparation			
US protocol			


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US results

Observations & Remarks			
	Student Signature	Instructor Signature	


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Student Name: _____ Clinical Site: _____

O - Observed DS - Direct Supervised IS - Indirect Supervised

NO	Procedure	Performed Date	Site	O	DS	IS
1	Example: Abdomen	1/1/2024	KAAUH	X		
2						
3						
4						
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 P.O. Box: 80324 Jeddah 21589

Contributors to the MRI sections of the manual:

Dr. Njoud Aldusary

Dr. Jaber Alyami

Dr. Duaa Banaja

Dr. Lamis Jada

Contributors to the US sections of the manual:

Dr. Fahad Almutairi

Dr. Salahalden Sultan

Dr. Abrar Alfatni

Dr. Rayan Anbar