

# Department of Radiologic Technology & Medical Imaging /NYCCT, CUNY

## SYLLABUS

**Course Requirement:** Required for students to graduate in the BSRS MR concentration

<b>Course Title</b>	<i>MR Anatomy, Pathophysiology and Instrumentation</i>
<b>Instructor /Office Hours</b>	
<b>Course Number</b>	RAD 3737
<b>Course Credits, Hours</b>	2.0 class hours, 2.0 lab hours, 3 credits
<b>Course Pre / Co-Requisites</b>	Admission to the BS in Radiological Science
<b>Catalog Course Description</b>	Both normal and pathologic magnetic resonance (MR) specific anatomy are reviewed. A thorough understanding of both normal and abnormal anatomy as they appear with and without MR contrast is required for the student to perform in clinical rotations, to correlate with other MR courses and, to some extent, with other relevant modalities including CT, Ultrasound and Nuclear Medicine. There is also a laboratory/tutorial component based on MR physics and problem solving for learning how to adjust technical parameters, patient positioning as well as operating and optimizing imaging equipment from major equipment manufacturers without direct physician interaction.

**Target Students and Expected Preparation:** This course is a required upper level science course for BS in Radiologic Sciences (MR Concentration) students. It will be offered ideally in the Fall Semester. All MRI students and some undecided students may take this upon their entry point into the BSRS program. We anticipate that there will be approximately 15 students taking the course. Appreciation for 3D visualization, human anatomy and tissue properties, physics, (particularly electricity magnetism and magnetic properties of materials), ability to assimilate web-based basic MRI theory and techniques will be useful.

### Course Characteristics

RAD 3737, MR Anatomy, Pathophysiology and Instrumentation is a common course in many bachelor programs in advanced imaging and is a required course for the BSRS MR concentration at City Tech. It will consist of 2.0 hours of didactic and 2.0 hours of lab practice sessions, one evening per week, where the topics are introduced, and applicable pathology and equipment operations are reviewed in lecture, tutorial format. Homework will be assigned on a regular basis, which will prepare the students for their midterm and final exams as well as for professional MR certification exam.

### Learning Outcomes and Assessments

#### *Magnetic Resonance Discipline specific*

<b>Learning outcomes (LOs)</b>	<b>Assessment</b>
1. Describe the anatomy of various human body parts as needed to position and understand MR images and associated artifacts effectively for satisfactory MR technologist function.	In-class quizzes (frequency determined by instructor) to evaluate students grasp of 3D relationships of normal anatomy
2. Describe the common pathologies usually	Analysis of diseases and common appearance of

encountered in a hospital MR department for various human body parts as needed to generate MR images reflecting affected parts.	pathology will be tested in home works, midterm and final exams.
3. Apply safety, sensitivity and specificity principles of various MR techniques for specific chronic and acute conditions.	Students will be asked to compare efficacy and diagnostic utility of various diagnostic tests in both midterm and final exams
4. Compute and implement protocol parameters as applicable to MR systems from different manufacturers per workplace standards for all ages, particularly when some patients need low power due to embedded medical devices.	Students will present to the rest of the class the range of workable protocols for various MR scans.
5. Build policies specific to MR protocol variation for safety, patient tolerability and diagnostic efficacy as per regulatory and scientific guidelines.	This will be evaluated during mid-term and final exams.

### *General Education Outcomes*

<b>Learning outcomes</b>	<b>Assessment</b>
1. Understand and employ both qualitative and quantitative analysis to describe disease screening challenges.	Students will be tested through several quizzes both qualitative and quantitative importance of disease screening by competing techniques.
2. Develop an in-depth appreciation of risks and benefits as related to technology.	Students will be assessed on written summaries of particular lecture/s or other sources comparing risk benefit ratios for various MR procedures.
3. Will be able to integrate expression and effects of diseases at various ages, in different cultures, and the role of society in healthcare.	Students will be tested during the final exam controversial ethical issues with understanding of cultural, genetic, ageing and bias components as part of personalized medicine.

### **Required Instructional Materials**

*Recommended textbook:* (abbreviated as RO, OS, SP, HE respectively from 1-5 below, **basic and required text is highlighted in RED.**)

1. Fundamentals of Body MRI: Expert Consult- Online and Print, 2<sup>nd</sup> Ed. (Fundamentals of Radiology) Elsevier Health. 2011. by Christopher G. Roth MD (**abbreviated RO**)
2. **Handbook of MRI Scanning by Geraldine Burghart and Carol Ann Finn**
3. Available in Web, OER: [Spine MRI lecture2 - Indiana University Bloomington.](http://www.indiana.edu/~mri/seminars/slides/Fall_2012/Spine%20MRI%20...) (PDF)
4. Diagnostic Imaging: Brain, 3<sup>rd</sup> Ed. Elsevier Health. 2015. by Anne Osborn, Karen Salzman, Miral Jhaveri and James Barkovich (**abbreviated OS**)
5. Musculoskeletal MRI. 2<sup>nd</sup> Ed. Saunders. Clyde Helms, Nancy Major, Mark Anderson, Phoebe Kaplan and Robert Dussault (**abbreviated HE**)
6. Materials for laboratory sessions (A-E): **All are open resources available in Web/ARRT**

- A. A review of MR physics: 3T versus 1.5T. by B.J. Soher et al. Magn Reson Imaging Clin N Am. 2007, 15(3):277-90.
- B. ARRT Clinical Experience Requirements for Post-Primary Magnetic Resonance Examination**
- C. ARRT Structured Education Requirements for Post-Primary Magnetic Resonance Examination**
- D. Typical Department/NYC hospital specific MR procedure/policy and device safety manuals
- E. Scanner/application vendor manuals/ACR QA and Accreditation details from ACR website

Homework assignments and the final exam are based on the topics presented in class as well as practice problems and applications in the lab. Typically, the homework and class participation will comprise 20% of final grade while midterm and final will cover the rest 80% and will be decided by the course instructor based on student suggestions at the beginning of the course.

### Weekly Topic Outline:

Week	Topic	Chapters/Sections	LOs
1	-Introduction/Physics of Body MR -MR Brain: <b>Congenital Malformations</b> <b>-Laboratory:</b> brief overview of exam types, equipment, vendor choices, nomenclature, protocol parameters	Ch 1: RO <b>Part-I Sec 1. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1, 2
2	- MR of Focal & Diffuse Liver Lesions - <b>MR of Head Trauma</b> (primary/secondary effects) <b>-Laboratory:</b> introductory MR physics, exam types, body and brain MR protocols	Ch 2, 3: RO <b>Part-I Sec 2. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1, 2
3	- MR Seminar on Spine - <b>MR Brain: Subarachnoid Hemorrhage &amp; Aneurysm</b> <b>-Laboratory:</b> More on MR physics, positioning, RF coils and head protocols	SP: PDF <b>Part-I Sec 3. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1,2
4	- MR of the GB and Biliary System - <b>MR of Stroke</b> including Nontraumatic Intracranial Hemorrhage, Atherosclerosis and Carotid Stenosis, Vasculopathy, Cerebral Ischemia and Infarction <b>-Laboratory:</b> More on MR physics, RF and gradient operations, head protocols	Ch 4: RO <b>Part-I Sec 4. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1, 2
5	-Basic principles/Tendons in MSK MR -MR of Stroke continued <b>-Laboratory:</b> Spine MR protocols	Ch 1, 3: HE <b>Part-I Sec 4. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1, 2
6	- <b>MR of Brain Neoplasms:</b> Astrocytic Tumors, Oligodendroglioma Tumors, Ependymal Tumors, Choroid Plexus Tumors, Neuronal and Glial Tumors, Pineal Tumors, Tumors of Cranial/Peripheral Nerves. <b>-Laboratory:</b> MR contrast physics and chemistry, body MR protocols	Ch 10, 11: HE <b>Ref 2,6 for Lab</b>	L.O. 1, 2
7	-MR of Wrist; MSK of Shoulder, Elbow	Ch 10-12: HE	L.O. 1-3

	----- <b>ALSO SAME DAY MID-TERM EXAM</b> -----		
8	- MR of the Pancreas, Spleen, Kidneys- MR Brain Infectious: Congenital /Neonatal Infections, Acquired Infections- <b>Laboratory:</b> High and low field differences, heating and safety issues, artifacts and in-depth head protocols	Ch 5, 6: RO <b>Part-I Sec 8. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1-4
9	- MR of Hips and Pelvis <b>-MR Brain: Inflammatory, and Demyelinating Disease.</b> <b>-Laboratory:</b> MSK protocols	Ch 14: HE <b>Part-I Sec 8. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1-4
10	-MR of Female Reproductive System <b>-Inherited Metabolic /Degenerative Disorders: Mitochondrial, Lysosomal, Peroxisomal, Organic &amp; Amino-acidopathic Disorders</b> <b>-Laboratory:</b> Quality, artifacts, MR Angio physics and suitable protocols	Ch 9, 10: RO <b>Part-I Sec 10. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1-5
11	-MR of Knee <b>- MR of Dementias and Degenerative Disorders</b> <b>- Laboratory:</b> More on MR Angio physics and suitable protocols	Ch 15: HE <b>Part-I Sec 10. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1-5 GLO 6
12	-MR of Foot & Ankle <b>-Anatomy-based Disorders: Ventricles and Cisterns: Normal Variants, Hydrocephalus</b> <b>- Laboratory:</b> MR diffusion physics and suitable protocols	Ch 16: HE <b>Part-II Sec 1. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1- 5 GLO 6, 7
13	- MR of the Prostate <b>- Sella and Pituitary ; CPA-IAC: Bell Palsy, Trigeminal Neuralgia, Vestibular Schwannoma, Meningioma</b> <b>- Laboratory:</b> MR spectroscopy physics and suitable protocols	Ch 11: RO <b>Part-II Sec 2, 3. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1- 5 GLO 6, 7
14	-Tumors in MSK MR <b>-Skull, Scalp, and Meninges:</b> Calvarial Defects, Cephalocele, Leptomeningeal Cyst, Fibrous Dysplasia, Paget Disease, Thick Skull, Sebaceous Cyst, Atypical and Malignant Meningioma, Benign and Malignant Mesenchymal Tumors, Calvarial Hemangioma, Dura/Venous Sinuses Hemangioma, Myeloma. <b>-Laboratory: ARRT Exam Review</b>	Ch 7: HE <b>Part-II Sec 4. OS</b> <b>Ref 2,6 for Lab</b>	L.O. 1- 5 GLO 6, 7
15	<b>Final exam: two parts</b> <b>(1) MR Anatomy/Pathophysiology/Instrumentation</b> <b>(2) Laboratory:</b> <b>Sample test similar to ARRT Exam</b>		

## **Grading Policy and Procedure**

*Scope of assignments and other course requirements:* Students will prepare homework assignments regularly. There will be at least 2 exams including the final exam.

*Method of grading:* Students will be evaluated through homework and exams. The final grade will be based on a weighted average of the grades from the homework and exams as follows:

Final Exam	40%
Midterm	40%
HW/quizzes/class participation	20%

### **NOTICE TO STUDENTS:**

Qualified students with disabilities, under applicable federal, state, and city laws, seeking reasonable accommodations or academic adjustments must contact The Center for Student Accessibility for information on CityTech's policy and procedures to obtain such services. Students with questions on eligibility or the need for temporary disability services should also contact the center at: The Center for Student Accessibility, 300 Jay street, room L-237 718-260-5143. [HTTP://www.citytech.cuny.edu/accessibility/](http://www.citytech.cuny.edu/accessibility/)

## **College academic integrity policy**

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion.

## **Class Participation**

A student must be able to devote sufficient time to complete assimilation of anatomy and pathophysiology of all body parts. The laboratory component will involve physical science concepts to safely modify existing protocols for greater accuracy or to meet changing departmental policy. Clinical rotations and performance in MR licensure examinations will depend on the proficiency achieved in this course. Deficiency in any particular areas of human anatomy and pathology or MR safety related parameters on a student's part due to non-participation will significantly affect his/her functioning in all clinical courses since every clinical week involves understanding of hospital policy and safe operability of MR scanners in the whole body. The laboratory component in this course discusses sample hospital policies from NYC hospitals. Students should attend all lectures.

## **Relationship to Programmatic Learning Outcomes**

This course will help students reach several programmatic learning outcomes of the Baccalaureate degree in Radiologic Sciences major. In particular, through this course students will:

- Develop a modest background in anatomy and pathology commonly encountered in MR imaging
- Connect the learned principles with advanced and clinical courses as well as will be able to have adequate discussions and scope of practice in the interactions with patients and physicians.
- Performance in Clinical rotations and in MR licensure examinations will depend on the proficiency achieved in this course.