SPRING 2017 – MRI CLASS

Faculty Information:	*Instructor*: TBA *Phone*: 201 693 0630 *E-mail*: **ajk0312@optonline.netu**
Course Description:	The objective of this 28 hour class is to prepare certified radiologic technologists for the successful completion of the post primary examination in Magnetic Resonance Imaging (MRI).
Class Meetings:	Lectures: **11 a.m. – 1 p.m.**
Required Textbooks:	Talbot, J., C, Kaut, C, Westbrook, K. MRI in Practice. (latest edition) Kelley, L**. Sectional Anatomy for Imaging Professionals**, textbook and workbook. (latest edition)
Additional Required Course Materials:	The following copyrighted materials are the sole property of the instructor. They are available on the instructor's website and are free for students enrolled in this course only. *MRI : PPT presentations* Konrad Consulting, Inc.

Success Criteria:	Final Exam **75%**	
Attendance Policy	For the students to receive credit for the seminar they must attend **100%** of the lectures. No absences in the seminar are allowed.	

Class	Topic	Chapter	Time
	MRI Class		
	Spring 2017 Outline		

1	**_Introduction to MRI_**
	1. Historical Perspective
	    1.. Research Contributors to MRI
	    2. Magnetic and Electromagnetic Phenomena
	    3. Faraday's law
	    4. Basic principle of MRI: data acquisition, reconstruction, and display
	        a. Precession
	        b. Larmor equation calculations
	        c. Gyromagnetic ratio
	        d. Resonance
	        e. RF pulse
	        f. FID
		PowerPoint	

2	**_Image weighting and Contrast_**
	  1. MRI factors:
	    a. Intrinsic: T1, T2, and Proton density relaxations
	    b. Extrinsic: TR, TE, Flip angle
	
	  2. Image Weighting
	    a. T1 Weighting
	    b. T2 Weighting
	    c. PD Weighting
	    d. T2* weighting
		PowerPoint	

3	**_MRI Instrumentation_**
	
	  1. MRI systems:
	    a. Permanent
	    b. Resistive
	    c. Superconducting
	
	  2. MRI coordinate system X, Y, and Z
	
	  3. Gradients their functions and parameters
	    a. Duty cycle
	    b. Slew rate
	    c. Rise time
	
	  4. Coils hardware and configuration
		PowerPoint	

Class	Topic	Chapter	Time

4	**_Signal Encoding and Image Formation in MRI_**
	
	1. Gradients Physical and Logical
	   a. Slice Selection and bandwidth
	   b. Frequency encoding
	   c. Phase Encoding
	   d. Sampling
	   e. Data Collection and Image Formation
	
	2. K-space
	   a. FFT
	   b. FOV
	   c. Matrix
	   d. Filling of k-space
	
	3. Data acquisition methods
	   a. Pre-scan
	   b. Sequential
	   c. 2D
	   d. 3D
		PowerPoint	

5	**_MRI Pulse Sequences 1_**
	  1. Conventional Spin Echo (CSE)
	  2. Fast Spin Echo (FSE)
	  3. k-space filling
	  4. Scanning time calculations
	
	3. Inversion Recovery
	     a. STIR
	     b. FLAIR
		PowerPoint	

6	**_MRI Pulse Sequences 2_** 1. Conventional Gradient Echo (GRE) 2. Coherent and coherent gradient echo 3. SSFP 4. EPI 5. Driven Equilibrium Prepared Technique 6. Scan time calculations	PowerPoint	

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7	**_MRI Parameters, Image Quality, and Trade-offs_**
	
	   1. Imaging Quality
	      a. Contrast to noise
	      b. Signal to Noise
	      c. Spatial resolution
	      d. Contrast resolution
	      e. Temporal Resolution
	      f. Scan Time
	   2. Imaging Parameters
	      a. TR
	      b. TE
	      c. TI
	      d. NSA
	      e. FOV
	      f. Matrix
	      g. Number of slices
	      h. Slice thickness and gap
	      i. Phase
	      j. Frequency
	      k. ETL
	      l. Effective TE
		PowerPoint	

8	**_MRI Image Artifacts and QA Procedures_**
	   1. Image Processing Artifacts
	      a. Aliasing
	      b. Chemical shift
	      c. Truncation
	      d. Partial volume
	   2. Patient Related Artifacts
	      a. Motion
	      b. Magic Angle
	   3. RF Related Artifacts
	      a. Cross-talk
	      b. Zipper artifacts
	      c. RF feedthrough
	      d. RF noise
	   4. Magnetic Susceptibility Artifacts
	   5. QA procedures in MRI
		PowerPoint	

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9	***Safety in MRI***
	
	1. Patient Screening and Testing Objects
	2. Safety of the Equipment
	3. Magnetic Field Strength and Safety
	4. RF safety
	5. Biological Aspects of MRI
	6. Patient Monitoring and Assessment
	7. Patient transfer
	    a. routine
	    b. Patient with medical equipment
	8. Contrast Media in MRI
	9. Emergency Response
		PowerPoint	

10	***Scanning of the Head and Neck***
	
	1. Surface and cross-sectional anatomy brief review
	
	2. Pathologies
	3. Patient preparation
	4. Protocols: parameters, anatomy and pathology demonstrated
	    a. Routine brain
	    b. IAC
	    c. Pituitary gland
	    d. Soft tissue neck
	    e. Sinuses
	    f. Orbits
	    g. fMRI
		PowerPoint	

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11	**_MRI of the Spine and Musculoskeletal System_**
	
	1. Surface and cross-sectional anatomy brief review
	2. Pathologies
	3. Patient preparation
	4. Protocols: parameters, anatomy and pathology demonstrated
	   a. C-spine
	   b. T-spine
	   c. LS-spine
	   d. TMJ
	   e. Shoulder
	   f. Elbow
	   g. Wrist
	   h. Hand
	   i. Hip
	   j. Ankle
	   k. Knee
	   l. Foot
	   m. Long Bones
	   n. Arthrography
		PowerPoint	

12	**_Vascular MRI_** 1. Vascular anatomy brief review 2. Pathologies 3. Patient preparation 4. Protocols: parameters, anatomy and pathology demonstrated: a. Mechanism of flow b. MRA c. MRV d. Vascular head e. Vascular neck f. Peripheral vascular g. Image reconstruction: MPR and 3D	PowerPoint	

Class	Topic	Chapter	Time

13	***MRI of the Thorax***
	
	1. Surface and cross-sectional anatomy brief review
	   2. Pathologies
	3. Patient preparation
	4. Protocols: parameters, anatomy and pathology demonstrated
	   a. Brachial plexus
	   b. Breast
	   c. Mediastinum
	   d. Cardiac
		PowerPoint	

14	***Review and Final Exam*** 1. Review 2. **Final Exam (75 questions)**	PowerPoint	