

American University of Beirut
Faculty of Health Sciences
Medical Imaging Sciences
MIMG 203
(Medical Imaging Equipment I)
Fall Semester

Name	Marlen S. Keushgerian	Meeting Location
Office Hours:		Meeting Time:
Office Location:	AUBMC SB 16	
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COURSE DESCRIPTION:

An introduction to various image-detecting and processing systems; description of analogue and digital detection systems. A detailed study of the x-ray tubes with methods of kV, mA, exposure time control, and control of scattered radiation.

Course Objectives:

- To provide the students with the knowledge of factors which govern and influence the production of the radiographic image.
- To acquaint the students with the knowledge of radiographic image processing. Description of for the analog and digital processing. Image receptors are introduced. Processing procedures and artifacts are described.
- To provide the students with the criteria to evaluate radiographs for the proper density, contrast, detail, noise and artifacts.
- To acquaint the students with digital and analog receptors and compare their properties.
- To offer the students an in depth knowledge and understanding of the x-ray tubes with methods of kV, mA, exposure time control and control of scattered radiation.

Credits Allocated: 3

Prerequisites: MIMG 202. Imaging Physics

Assignments: None

Student Assessment / Basis of Grade determination

Grades for this course will be based on the following criteria:

Quiz I	30 %
Quiz II	30 %
Final exam	35 %
Class attendance and participation	5%

COURSE SYLLABUS

- I- Introduction to computers
 - 1- History
 - 2- What is a computer?
 - 3- Types of digital computers
 - 4- Fundamentals of computer technology
 - 5- Computer programs
 - 6- Operating system for a microcomputer
 - 7- Assembler:
 - 8- Windows
 - 9- Architecture
 - 10- Central processing unit
 - 11- Mass storage devices
 - 12- How does the CPU work?
 - 13- Peripherals
 - 14- Input/output devices
 - 15- Processing methods
 - 16- Microprocessors in radiology
- II- Films in radiographic imaging
- III- Luminescence
- IV- Screens in radiographic imaging
 - 1- Intensifying screens
 - 2- Efficiency of screens
 - 3- Types of phosphors
 - 4- Quantum detection efficiency
 - 5- Conversion efficiency
 - 6- Advantages of rare earth over conventional
 - 7- Screen characteristics
 - 8- Types of screens
 - 9- Resolution
 - 10- Sharpness
 - 11- Cross-over effect
 - 12- Parallax
 - 13- Single screen radiography
 - 14- Matching spectral sensitivity of phosphors and films
 - 15- Care and maintenance of intensifying screens

- 16- Mounting intensifying screens
- 17- Checking artifacts of screens
- 18- Poor screen film contrast
- V- Digital radiography
 - 1- Digital image
 - 2- Digital image display
 - 3- Digital radiography
 - 4- Photostimulable phosphor plates. Computed radiography.
 - 5- Indirect / direct digital radiography
 - 6- Digital radiography system components
 - 7- Chain of events during the acquisition of a digital system
 - 8- Chain of events during the acquisition of an indirect digital radiography system
 - 9- Chain of events during the acquisition of a direct digital radiography system
- VI- Dry laser printing
 - 1- The laser imager
 - 2- Why laser
 - 3- Laser types
 - 4- Generic laser beam modulation
 - 5- Thermal processing
 - 6- Laser imager in use
 - 7- Advantages of a laser imager
- VII- Image Clarity
 - 1- Contrast
 - 2- Image quality
 - 3- Viewing conditions
 - 4- Resolution
 - 5- Artifacts
- VIII- Digital image processing
 - 1- The human visual system
 - 2- The digital image
 - 3- Fundamentals of image processing
 - 4- Creating a digital image
 - 5- Quality of digital image
- IX- Information management
 - 1- Hospital information system
 - 2- Radiology information system
 - 3- PACS
 - 4- Teleradiology
- X- Introduction to imaging scheme
 - 1- Components of the scheme
 - 2- Purpose of the imaging scheme
- XI- X-ray Tubes
 - 1- Basic function of x – ray tubes
 - 2- Components of x-ray tubes
 - 3- Difference between rotating and stationary anode tubes

- 4- Principles of anode rotation
- 5- Line focus principle
- 6- Heel effect
- 7- Variation in x-ray tube design
- XII- Heat and methods of heat transfer
 - 1- Heat as energy
 - 2- Methods of heat transfer
 - 3- Heat dissipation techniques in
 - 4- Rating charts
 - 5- Heat units
 - 6- Anode cooling charts
- XIII- Filtration
 - 1- Process of filtration
 - 2- Inherent filtration
 - 3- Added filtration
 - 4- Effect of filtration on exposure
- XIV- Tube failures
 - 1- Areas of tube failure

Bibliography / References

- Graham, D.T., Cloke, P. & Vosper, M. (2011). Principles and Applications of Radiological Physics. 6th ed. Elsevier.
- Books LLC (2010). Radiography: X – Ray, X – Ray Computed Tomography, Wilhelm Roentgen, Radiologic Technologist, Medical Radiography, Industrial Radiography. Books LLC.
- Martin, B.R. (2009). Nuclear Particle Physics and Introduction. Wiley.
- Roberts, P.A. & Williams, J. (2008). Farr’s Physics for Medical Imaging. Saunders Elsevier.
- Carroll, Q.B. (2007). Instructor’s Manual for Use with Practical Radiographic Imaging. (9th ed.). Thomas.
- Carroll, Q.B. (2007). Practical Radiographic Imaging. (8th ed.). Thomas.
- Huda, W. (2010). Review of Radiological Physics. (3rd ed.). Lippincott Williams & Wilkins.

Author (s) of Syllabus and resume (s)

- Marlen S. Keushgerian (resume attached)

COURSE POLICY

1. **Attendance:** you are expected to attend all classes and participate in class activities. If you miss a class, it is your responsibility to make up for the material missed, and inquire about any announcements made. If you miss more than one fifth of class sessions, you are subject to withdrawing from the course with a-w-grade. *Please refer to the AUB catalogue.*

2. **Exams:** Examinations must be taken as scheduled. Make up exams will not be given unless a valid excuse is given. Only authorized medical reports will be accepted. (AUBMC/ Infirmary)
3. **Withdrawal date:** Please observe withdrawal dates set by the Registrar's Office.
4. **Academic integrity:** Any act of cheating or plagiarism is a violation of academic integrity and will not be tolerated. Kindly refer to student handbook or refer to AUB Policies and Procedures on academic integrity. <http://pmp.au.edu.lb/university/handbook/158010044.html>.
5. **E-mail communication:** Students will be e – mailed on regular basis throughout the semester.
6. **Special needs:** 'AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314'.