

BME 527: Integration of Medical Imaging Systems Fall 2016

1. Basic Course Information

<i>Course name</i>	Integration of Medical Imaging Systems
<i>Units</i>	3.0
<i>Place and time</i>	OHE 100B; (Fri, 9:00-11:50 am)
<i>Instructor</i>	Brent J. Liu, Ph.D., Department of Biomedical Engineering brentliu@usc.edu, DRB 264, (213) 821-1912
<i>Textbook</i>	<u>PACS and Imaging Informatics, 2nd edition</u> , by H.K. Huang, Wiley & Sons, 2010

Relevant reading material and exercises will be provided by the instructor

2. Course Overview and Learning Objectives

Overview: This course will introduce the concepts related to Imaging Informatics systems utilized within the clinical environment including the Picture Archiving and Communication System (PACS), the Radiology Information System (RIS), and the Electronic Medical Record (EMR). The primary focus will be on concepts surrounding the PACS but will cover integration with other clinically relevant systems. Topics will include medical imaging quality, compression, data standards such as DICOM (Digital Imaging and Communications in Medicine) and HL7 (Health Level 7), workflow analysis and protocols such as IHE (Integrating the Healthcare Enterprise), networks, image security, fault tolerance, image database and backup. The course will take an in-depth view of each of the sub-components of the PACS and the impact to overall clinical workflow. In addition, there will be a hands-on LAB component where students will interact with a PACS Simulator to observe data and clinical workflow, downtime scenarios, and troubleshooting. The course will be designed with the intention to prepare, in part, for certification exams currently available to students looking to further or expand their career goals in the Imaging Informatics industry as well as healthcare institutions.

Course Objectives: Students will be able to:

- Understand the current engineering techniques and their applications in clinical systems for medical imaging informatics.
- Learn the basic concepts of Medical Imaging, Imaging Informatics, clinical workflow, and clinical information systems.
- Identify the major subcomponents of a PACS and how it integrates with other clinical information systems within the healthcare enterprise.
- Develop skills in written communications.

3. Course Plan

The course plan is designed to introduce basic concepts of Medical Imaging Informatics with an introduction to clinical information systems (eg, PACS, RIS, EMR). The timeline is subject to change, at the instructor's discretion.

- Aug 26 Course Introduction Overview and Outline

- Sep 2 Introduction
 - Medical Images
 - Clinical System Fundamentals
 - Introduction to Radiology WorkflowMedical Imaging Fundamentals
 - Image Quality
 - Spatial and Frequency Domains
 - Image Transformation

- Sep 9 Imaging Informatics of Modality Systems:
 - Projection Radiography: CR, DR, Digital Mammography

- Sep 16 Imaging Informatics of Modality Systems:
 - Sectional Imaging: CT, MR, US, NM/PET/SPEC

- Sep 23 Medical Image Compression
 - Lossless
 - Lossy
 - Cosine Transform
 - Wavelet Transform

- Sep 30 Health Care Information Industrial Standards & Workflow Protocols
 - DICOM (Digital Imaging and Communication in Medicine)
 - HL - 7 (Health Level 7)
 - IHE (Integrating the Healthcare Enterprise)

- Oct 7 Picture Archiving and Communication System (PACS) Overview
 - Concept
 - Components
 - Data Flow

- Oct 14 System Gateways:
 - Image Acquisition Gateway
 - Healthcare Data GatewayDisplay Workstations:
 - Components

Types
Functions
GUI

- Oct 21 Midterm Exam Closed Book**
- Oct 28 PACS Controller and Archive Server
Components
Software Design
Data Flow
Fault-Tolerance
Communication Networks
LAN and WAN, Internet and Intranet
TCP/IP Protocols
Internet 2
PACS Networks
Teleradiology Networks
- Nov 4 Implementation of PACS in a Clinical Environment
PACS Acceptance Testing Design & Implementation
- Nov 11 Telemedicine and Teleradiology
Components
Trade-off Parameters
Operation
Radiology & Clinical Impact
- Nov 18 Integration of HIS/EMR, RIS, PACS, and ePR
HIS: Hospital Information System
EMR: Electronic Medical Record
RIS: Radiology Information System
ePR: electronic Patient Record
- Nov 25 Thanksgiving Holiday: NO CLASS**
- Dec 2 Special Guest Lecture/Seminar
- Dec 7-14 TAKE HOME FINAL**

4. Assignments

Homework: There will be 4-5 homework sets which will be assigned a week before they are due. Assignments are due on the specified date at the beginning of class.

Midterm Exam: A midterm exam will cover the topics up to the midterm and will be assigned a week before it is due. There will be no make-up exam.

Take Home Final Exam: A Take Home Final exam will be administered to cover all the topics of the course.

5. Grades

Final grades will be based on homework assignments (30%), a mid-term exam (30%), and a take home final exam (40%).

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.