COURSE DESCRIPTION

Department and Course Number	CS451	**Course Coordinator**	Eun-Young (Elaine) Kang
Course Title	Multimedia Software Systems	**Total Credits**	4

Current Catalog Description:

Introduction to Multimedia Information and Processing. Topics: Basic Signal Processing. Color Space, Formations of image, video, and audio data. Current standards and the state-of-art techniques for multimedia systems.

Textbook:

Handouts and reading materials (technical papers) provided by the instructor.

References:

- Pratt, William, *Digital Image Processing, 3rd Ed.*, John Wiley & Sons Inc., 2001.
- Efford, Nick, *Digital Image Processing: A practical introduction using Java,* Addision-Wisley, 2000.
- Watt, Alan and Policarpo, Fabio,. *The Computer Image,* Addison Wesley, 1998.
- Steinmetz, R. and Hahrstedt, K. *Multimedia Fundamentals, Vol1,* Prentice Hall, 2002.
- Raghavan, S.V. and Tripathi, S.K. *Networked Multimedia Systems: Concepts, Architecture, and Design,* Prentice Hall, 1998.
- Kuo, F. and Effelsberg, W. and J.J.Garcia-Luna-Aceves, *Multimedia Communications: Protocols and Applications,* 1998 Prentice Hall, 2000.
- Sun, M. *Compressed Video over Networks,* Marcel Dkker, 2000.
- Ghanbari, M. *Video Coding: An Introduction to Standard Codecs, The Institution of Electrical Engineering (IEE),* London, UK, 1999.
- *ISO Official JPEG Homepage: http://www.jpeg.org/jpeg/index.html*
- *ISO Official JPEG 2000 Homepage: http://www.jpeg.org/jpeg2000/index.html*
- *ISO/IEC Official MPEG Homepage: http://www.chiariglione.org/mpeg/*

Course Goals:

At the end of the course, students

- Understand the current multimedia data types (images, video, audio, graphics etc).
- Are familiar with the requirements and the algorithms for multimedia systems.
- Understand efficient design solutions and established standards for multimedia.
- Gain programming experiences in multimedia processing
- Develop a multimedia software system related to video (audio) codec, multimedia database, or other multimedia software application on network.

These course goals contribute to the success of **Student Learning Outcomes 1.a, 2, 3, 5, and 6**.

Prerequisites by Topic:

- Very good programming skills in Java or C++
- Basic knowledge of data structure and computer algorithms

Major Topics Covered in the Course:

- Introduction to Multimedia.
  - Definition of multimedia
  - Taxonomy of multimedia
  - Issues and Applications
- Digital Data Acquisition
  - Basic signal processing
  - Media formats
- Coding Theory
  - Need for compression
  - Lossless and lossy compression techniques.
- Image Compression Techniques and Standards
  - JPEG, JPEG2000
  - Half-toning, dithering, and error diffusion
- Color Theory
  - Color problem, color response, TriStimulus vectors
  - Color space
  - Color quantization
- Video Compression Techniques and Standards
  - Modality of video
  - Motion compensation
  - Standards – MPEG, ITU standards
- Audio Compression Techniques and Standards
  - Characteristics of sound and audio signals
  - Sound compression techniques
  - Audio compression standards

- 2D/3D Graphics
  - 3D model simplification
  - 3D model compression
- MPEG-4

Laboratory Projects (specify number of weeks on each):

Through out the quarter, students are required to work on homework or a project.

- Week 1-2: Be familiar with an image input/output method.
- Week 3-4: Implement a lossless entropy coding algorithm.
- Week 4-7: Implement a lossy image compression/decompression algorithm.
- Week 7-10: Implement a multimedia software system related to video (audio) codec, multimedia database, or other multimedia software application on network.

Estimate Curriculum Category Content (Quarter Hours)

Area	Core	Advanced	Area	Core	Advanced
Algorithms		0.5	Data Structures		0.5
Software Design		1.0	Prog. Languages		2.0
Comp. Arch.					

Oral and Written Communications:

Written documentation of software built in labs and homework assignments.

Social and Ethical Issues:

No significant component.

Theoretical Content:

Coding Theory, Color Theory.

Problem Analysis:

Students are first required to understand the basic features of multimedia (e.g., huge data sets of digitized samples, spatial and temporal coherence of data, and repetitive computations per sample), underlying processing algorithms, and the standard solutions for each media type. Then they are required to develop reusable software that manages its use of memory efficiently.

Solution Design:

Solution design involves a divide-and-conquer modular approach. Given a problem, students are required to identify independent components of the problem so that they can develop modules isolating each component from the rest, identify where implementation problems occur, and focus on making the individual modules efficient. For the implementation of each component, students are required to identify memory intensive components, computation intensive components, and computationally reusable components so that they can design optimized codes while avoiding inefficient memory allocation and repetitions of the same computations.