

Course name	Multimedia Systems		
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Course ID:	40-342	Credits:	3	Program:	Undergraduate
Prerequisites:	Signals & Systems			Co-requisites:	-
Prepared by:	Mahdi Amiri				

Aim

- To make the senior level undergraduate students acquainted with the fundamental concepts of multimedia and multimedia systems in emerging multimedia value added services.

Outline

1. Introduction to Multimedia
 - a. Overview of the course
 - b. What is Multimedia?
 - c. What is Multimedia System?
 - d. HyperMedia
 - e. Multimedia Systems Characteristics, Challenges, and Components.
 - f. Multimedia Data
 - g. Multimedia Research Topics and Projects
 - i. Processing: e.g. content-based retrieval
 - ii. Networking: e.g. QoS
 - iii. End-Systems: e.g. User Interfaces
 - iv. Interaction: e.g. “ubiquity” devices
2. Review of Signals and Systems
 - a. What is “signal”!?
 - b. Discrete-time signals and systems
 - c. Sampling theorem
 - d. Quantization (Scalar Q., Vector Q.)
 - e. Transform domain analysis
 - f. FFT, STFT, Wavelet.
3. Audio
 - a. Audio representations
 - i. Audio sampling and quantization
 - ii. Formats and standards
 - b. Frequency Masking vs. Temporal Masking
 - c. Speech processing
 - i. Synthesis, recognition, ...
 - d. Audio Compression
 - i. PCM (u-law, a-law), DPCM, ADPCM, LPC, CELP
4. Entropy Coding
 - a. Lossy and lossless compression
 - b. Run-length encoding
 - c. Fixed Length Coding (FLC)
 - d. Variable Length Coding (VLC)
 - e. Huffman Coding Algorithm

- f. Lempel-Ziv-Welch (LZW)
 - g. Arithmetic Coding
- 5. Image
 - a. Color space: YUV, RGB, HSV, CMYK, ...
 - b. Acquisition and Representation
 - i. Color depth
 - ii. Dithering
 - iii. Image resolution
 - iv. High-Dynamic-Range (HDR)
 - v. Bracketing
 - c. Enhancement
 - i. Histogram Equalization
 - ii. Gamma Correction
 - iii. Gaussian smoothing
 - d. Compression
 - i. DCT, JPEG
- 6. Video
 - a. Basics of Analog and Digital Video
 - b. Video Compression Review
 - c. Inter frame and intra frame coding
 - d. Motion Estimation and Compensation
 - e. Video Quality Evaluation
 - f. Video Coding standards
 - i. MPEG1, MPEG2, MPEG4 , H.261, H.263, H.264, ...
- 7. Multimedia System Design
 - a. Standalone vs. Networked
 - b. Live vs. Orchestrated
 - c. Multimedia system building blocks
 - d. Real-time multimedia system architecture
- 8. Multimedia Networking
 - a. Quality of Multimedia Data Transmission
 - b. Streaming protocols
 - c. Error concealment
 - d. Prioritized Encoding
 - e. Overlay networks
 - f. Packet-loss, Congestion, QoS
 - g. Unicasting and Multicasting
 - h. Wireless multimedia
- 9. Multimedia Applications
 - a. Internet Telephony
 - b. Digital Video Broadcasting (DVB)
 - c. Interactive TV, Internet-TV, IPTV
 - d. E-Learning
 - e. Human Computer Interface
 - f. Multimedia Home Platform (MHP)
 - g. Multimedia Information Retrieval System

- h. 3D Technologies**
 - i. Depth perception**
 - ii. Stereoscopic**
 - iii. Autostereoscopic**
 - iv. Computer-Generated Holography (CGH)**
 - v. Volumetric displays**

Evaluation Criteria

Quiz:	15%
Homework:	15%
Critical Reading:	10%
Midterm exam:	30%
Final exam:	30%

References

- 1. R. Steinmetz and K. Nahrstedt, Multimedia: Computing, Communications and Applications, Prentice Hall, 1995.**
- 2. R. Steinmetz and K. Nahrstedt, Multimedia Fundamentals: Media Coding and Content Processing, Prentice Hall, 2002.**
- 3. K. R. Rao, Z. S. Bojkovic and D. A. Milanovic, Multimedia Communication Systems: Techniques, Standards and Networks, Prentice Hall, 2002.**