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<tr>
<th>Course ID:</th>
<th>40-342</th>
<th>Credits:</th>
<th>3</th>
<th>Program:</th>
<th>Undergraduate</th>
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<tr>
<td>Prerequisites:</td>
<td>Signals &amp; Systems</td>
<td>Co-requisites:</td>
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<td>Prepared by:</td>
<td>Mahdi Amiri</td>
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**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
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