



الجامعة الافتراضية السورية  
SYRIAN VIRTUAL UNIVERSITY

## Multimedia Systems

### Course Definition

**I**nformation

**T**echnology

**E**ngineering



|   |  |                                    |
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## 1. Basic Information:

|  |                    |
|--|--------------------|
| <b>Course Name</b>                           | Multimedia Systems |
| <b>Course Code</b>                           | BMM601             |
| <b>Number of Presentational Sessions*</b>    | 20                 |
| <b>Number of Synchronous Sessions**</b>      | 10                 |
| <b>Number of Shorter Tests***</b>            | 2                  |
| <b>Number of Exams***</b>                    | 1                  |
| <b>Theoretical Sessions Work Load (hrs.)</b> | 60                 |
| <b>Practical Sessions Work Load (hrs.)</b>   | 30                 |
| <b>Credit Hours</b>                          | 6                  |

\*Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs.).

\*\*Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs.).

\*\*\*Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.

**N.B.**

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions (. This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

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## 2. Prerequisites courses:

| Course              | Code   |
|---------------------|--------|
| Computer Graphics   | BCG601 |
| Computer Networks I | BNT501 |

## 3. Course Objectives:

The Multimedia Systems course, deals with the art of multimedia, its tools, and its elements such as digital images, digital video, and digital audio. It also deals with some digital image processing techniques. In the field of information compression, the course introduces static image, video, and MP3 audio compression standards. For transmitting multimedia over the network, the course deals with the multimedia network protocols and applications.

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#### 4. Learning Outcomes (LO):

By the end of this course, the learner is expected to acquire and learn the following subjects:

1. Learning about multimedia and its tools
  - Multimedia definition
  - Multimedia elements and sections
  - Multimedia software tools
2. Learning about digital Images
  - Color models in Images and color schemes in videos
  - Forming images in digital cameras and computers
  - Digital image types and common image file formats
3. Learning about digital video
  - Types of video signals
  - Analog video signal
  - Video digital representation
4. Learning about digital audio
  - Audio definition
  - Audio receiving
  - Audio sampling and digitization
  - Audio coding
5. Learning about digital image processing techniques
  - Scaling (zoom in/out) images
  - Basic relations on image elements
  - Enhancement digital image using spatial filters
  - Enhancement digital image using frequency filters

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## 6. Learning about information compression techniques

- Information theory
- Variable–Length Coding (VLC)
- Arithmetic coding
- image compression techniques
- Lossless compression techniques
- Lossy compression techniques

## 7. Learning about static image compression standards

- JPEG standard
- Basic steps of JPEG standard
- JPEG models
- Overview of JPEG series

## 8. Learning about video compression standards

- Compression video using motion compensation
- Most common video compression standards (H.261, MPEG, MPEG – 2)

## 9. Learning about MP3 audio compression standards

- Auditory model
- MPEG audio

## 10. Learning about multimedia network protocols and applications

- Transmission quality
- Classification of multimedia services
- Multimedia over IP
- Internet telephony

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## 5. Assessment Results:

| Chapter Number | Chapter Title                | General Objectives  | Assessment Type                         |                                      |                            |                              |         |
|----------------|------------------------------|---|---|--------------------------------------|----------------------------|------------------------------|---------|
|                |                              |   | Interactive Content & Recorded Sessions | Applied Activities (Synch. Sessions) | Final Exam*/ Shorter Tests | Presentations and Interviews | Reports |
| CH1            | Multimedia art and its tools | Comprehension<br>–Analytical Thinking –<br>Tools and Application<br>Hands– On | √                                       | √                                    | √                          | √                            | √       |
| CH2            | Digital images               | Comprehension<br>–Analytical Thinking –<br>Tools and Application<br>Hands– On | √                                       | √                                    | √                          | √                            | √       |
| CH3            | Digital video                | Comprehension<br>–Analytical Thinking –<br>Tools and Application<br>Hands– On | √                                       | √                                    | √                          | √                            | √       |
| CH4            | Digital audio                | Comprehension<br>–Analytical  | √                                       | √                                    | √                          | √                            | √       |

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|            |  | Thinking –<br>Tools and<br>Application<br>Hands– On                                 |   |   |   |   |   |
|------------|--|---|---|---|---|---|---|
| <b>CH5</b> | Digital<br>image<br>processing<br>techniques | Comprehension<br>–Analytical<br>Thinking –<br>Tools and<br>Application<br>Hands– On | √ | √ | √ | √ | √ |
| <b>CH6</b> | Information<br>compression<br>techniques     | Comprehension<br>–Analytical<br>Thinking –<br>Tools and<br>Application<br>Hands– On | √ | √ | √ | √ | √ |
| <b>CH7</b> | Static image<br>compression<br>standards     | Comprehension<br>–Analytical<br>Thinking –<br>Tools and<br>Application<br>Hands– On | √ | √ | √ | √ | √ |
| <b>CH8</b> | Video<br>compression<br>standards            | Comprehension<br>–Analytical<br>Thinking –<br>Tools and                             | √ | √ | √ | √ | √ |

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|             |   | Application<br>Hands- On  |   |   |   |   |   |
|-------------|---|---|---|---|---|---|---|
| <b>CH9</b>  | MP3 audio<br>compression<br>standards                     | Comprehension<br>-Analytical<br>Thinking -<br>Tools and<br>Application<br>Hands- On | √ | √ | √ | √ | √ |
| <b>CH10</b> | Multimedia<br>network<br>protocols<br>and<br>applications | Comprehension<br>-Analytical<br>Thinking -<br>Tools and<br>Application<br>Hands- On | √ | √ | √ | √ | √ |

\*The final exam is two hours long and is given at the end of the course.

\*\*Shorter tests are about 30 minutes long and are given after three or four lectures throughout the semester during synchronous sessions.

\*\*\*Presentations, interviews, and reports are submitted once after each three or four lectures throughout the semester during synchronous sessions.



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## 6. Course Syllabus:

| Chapter | Subject                      | Content  | Number of Learning Objects | Number of synchronous Learning Objects |
|---------|------------------------------|--|----------------------------|--|
| CH1     | Multimedia art and its tools | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Multimedia definition</li> <li>3. Multimedia elements</li> <li>4. Multimedia sections</li> <li>5. Multimedia software tools</li> <li>6. Examples and exercises</li> </ol>                                       | 7                          | 3                                      |
| CH2     | Digital images               | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Vision elements</li> <li>3. Color models in images</li> <li>4. Video color scheme</li> <li>5. Forming images in digital cameras</li> <li>6. Forming images in computers</li> <li>7. Types of digital</li> </ol> | 8                          | 4                                      |

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|     |               | images<br>8. Common image file formats  |   |   |
| CH3 | Digital video | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Types of video signals</li> <li>3. The analog video signal and its representation in analog television systems</li> <li>4. Digital video features and color segmentation</li> <li>5. Explanation of some standards related to digital video</li> <li>6. Examples and exercises.</li> </ol> | 6 | 3 |
| CH4 | Digital audio | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Audio definition</li> <li>3. Explanation of the audio receiving mechanism</li> <li>4. Sampling audio</li> </ol>  | 6 | 3 |

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|     |                                     | <p>process and explaining some basic concepts about sampling</p> <p>5. Regular and irregular quantification process</p> <p>6. Examples and exercises.</p>  |   |   |
| CH5 | Digital image processing techniques | <p>1. Introduction</p> <p>2. Scaling (zoom in/out) images</p> <p>3. Basic relations on image elements</p> <p>4. Enhancement digital image using spatial filter</p> <p>5. Enhancement digital image using frequency filter</p> <p>6. Examples and exercises</p> | 6 | 3 |
| CH6 | Information compression techniques  | <p>1. Introduction</p> <p>2. information theory definition and</p>   | 6 | 3 |

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|     |                                    | <p>measurement of the average amount of information (entropy)</p> <p>3. Definition of variable length encoding and Huffman encoding</p> <p>4. Definition of arithmetic coding and its application</p> <p>5. Definition of conservative (lossless) and lossy compression techniques compression and the most important criteria for each.</p> <p>6. Examples and exercises.</p> |    |   |
| CH7 | Static image compression standards | <p>1. Introduction</p> <p>2. JPEG standard</p> <p>3. Basic steps of JPEG standard</p>  | 10 | 5 |

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|     |                             | <ol style="list-style-type: none"> <li>4. JPEG models</li> <li>5. Serial JPEG model</li> <li>6. Progressive JPEG model</li> <li>7. Structured JPEG model</li> <li>8. Conservative JPEG model</li> <li>9. Overview of JPEG series</li> <li>10. Examples and exercises.</li> </ol>         |   |   |
| CH8 | Video compression standards | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Definition and explanation of video compression mechanism using motion compensation (searching methods for motion radiation)</li> <li>3. Definition and explanation of video compression standards (H.261,</li> </ol> | 4 | 2 |

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|      |   | MPEG, MPEG – 2)<br>4. Examples and exercises.   |   |   |
| CH9  | MP3 audio compression standards               | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Definition of the audio compression process and the most important algorithms used in audio compression</li> <li>3. Definition of the auditory model and the most important properties related to the human ear</li> <li>4. Explanation of the MPEJ audio compression algorithm and its stages</li> <li>5. Examples and exercises</li> </ol> | 5 | 2 |
| CH10 | Multimedia network protocols and applications | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Definition of transmission quality and its most</li> </ol>   | 6 | 3 |

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|  |  | <p>important parameters</p> <p>3. Classification of multimedia services according to transmission quality standards</p> <p>4. Explanation of the concept of multimedia over IP and learn about its most important protocols and technologies</p> <p>5. Definition of the concept of Internet telephony and explanation of its most important advantages and protocols.</p> <p>6. Examples and exercises</p> |  |  |
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## 7. Practical Activity:

- **Tools and Labs:**

| Tool Name | Description     |
|-----------|-----------------|
| Python    | On Google Colab |

- **Practical Activities per Chapters:**

| Chapter | Activities Type   | Remarks |
|---------|---|---------|
| CH1     | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other |         |
| CH2     | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other |         |
| CH3     | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input checked="" type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment                        |         |



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|            | <input type="checkbox"/> Other   |  |
| <b>CH4</b> | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other            |  |
| <b>CH5</b> | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other            |  |
| <b>CH6</b> | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other            |  |
| <b>CH7</b> | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input checked="" type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other |  |
| <b>CH8</b> | <input checked="" type="checkbox"/> Exercises  |  |

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|             | <input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other   |  |
| <b>CH9</b>  | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other            |  |
| <b>CH10</b> | <input checked="" type="checkbox"/> Exercises<br><input checked="" type="checkbox"/> Homework<br><input type="checkbox"/> Webinars<br><input checked="" type="checkbox"/> Project<br><input type="checkbox"/> Experiment<br><input type="checkbox"/> Other |  |

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## 8. References:

1. “Multimedia Systems” by Ralf Steinmetz and Klara Nahrstedt.
2. “Introduction to Data Compression” by K Sayood.
3. “H.264 and MPEG–4 Video Compression” by Iain E G Richardson.
4. “Multimedia Systems, Standards, and Networks” by A Puri and T Chen.