Multimedia Engineering

1. **Course number and name:** 020VTLES5 Multimedia Engineering

2. **Credits and contact hours:** 4 ECTS credits, 2x1h15

3. **Instructor's or course coordinator's name:** Rabih Moawad

4. **Text book:**
    a. **Other supplemental materials:**
       Handout and lecture slides

   References:
   Standard Handbook of Video and Television Engineering, Jerry C. Whitaker, B. Benson, McGraw Hill, 4th Edition, 2003.

5. **Specific course information**
    a. **Catalog description:**
       Video signal, Luminance, Chrominance, Interlaced and progressive scanning. Frame rate, resolution. Horizontal and Vertical Sync. Video bandwidth. TV analog systems: PAL, NTSC. Camera sensors: CCD and CMOS. Flat Screens technology: LCD, Plasma and OLED. CD, DVD and BluRay. Digital TV Signal: CCIR601.AES/EBU and embedded Audio. JPEG. Video and Audio Compression: MPEG2 and MPEG4 (H264). DVB: Digital Video Broadcast, DVB2. HDTV. Video and Audio on Networks.

    b. **Prerequisites:** 020THSES2 Signal theory

    c. **Required:** Elective for CCE students

6. **Specific goals for the course**
    a. At the completion of the course, students will be able to:
       - Understand and use correctly technical data and some equipment in the video and Television fields, in analog and digital modes.
       - Select the suitable camera sensors technology for a specific application based on the knowledge of the technologies strengths and weaknesses.
       - Select the suitable screen technology for a specific application based on the knowledge of the technologies strengths and weaknesses.
       - Understand video and audio compression standards MPEG2 and MPEG4 which could be used in multiple fields such as Television broadcast, IPTV, video streaming, Virtual and augmented reality, Telepresence, Tele-medicine…
       - Understand DVB and DVB2 technologies and parameters in order to work on or implement a DVB network.
       - Learn how to use the VideoLan software VLC in order to work on video and audio parameters, to compare different video and audio formats based on

quality and bitrate, as well as using different protocols for video streaming and broadcasting.

b. **KPI addressed by the course:**

KPI	a2	a3	b3	b4	e1	e3	i1	i3	k1	k2	k3
Covered	x	x	x	x	x	x	x	x	x	x	x
Assessed	x	x	x	x	x	x			x	x	x

7. Topics and approximate lecture hours:
- Analog video signal: scanning, generation, components, bandwidth, synchronization and transmission. TV channels. Analog audio processing and modulation.
- Color Video signal: Luminance and chrominance signals. Analog TV color systems specs: NTSC and PAL.
- Camera sensors: CCD and CMOS technologies description, comparison and specs. Advantages and disadvantages of each technology and application fields.
- Flat Screens: LCD Plasma and OLED technologies description, comparison and specs. Advantages and disadvantages of each technology and application fields.
- Digital Video signal CCIR601: specs, sampling frequency, sampling rate 4:2:2, frame structure, audio coding: AES/EBU and embedded audio.
- JPEG: Image compression standard description and processing techniques. Lossy and lossless compression.
- MPEG2 video compression: standard description, video compression techniques: spatial and temporal. Audio compression: Psychoacoustic model, standards (mp1, mp2, mp3 and AC-3(on DVD)). System information data coding.
- MPEG4 (H264) video compression: standard for HDTV and Internet. Object-oriented, scalability, interactivity. Natural and synthetic video and audio as well as multimedia. Applications: Virtual reality, augmented reality, telepresence…
- DVB: Digital Video Broadcast. DVB-S (satellite), DVB-C (cable) and DVB-T (terrestrial) standards description and specs. DVB version 2: DVB-S2, DVB-C2 and DVB-T2, standards description and specs.
- CD, DVD, BluRay storage for digital audio and video. Techniques description and specs of different types – and +,R, RW…Application fields.
- HDTV: High Definition Television, specs and advantages compared to standard TV.

- 2 **Labs** on VideoLan's software VLC about digital video signal parameters, video streaming and broadcasting using different protocols and video compression comparing MPEG2 and MPEG4 (H264) standard.