|  |
| --- |
| **Audio-Visual Systems I (60 h)** |

***1-General objectives***

At the end of this course, the student will be able to:

1- Describe the characteristics of the sound.

3- State the physical properties of the sound.

4- Know the different types of the sound.

5- Know the audible frequency ranges.

6- State the properties of the musical sound and speech.

7- Determine the sensitivity of the ear with respect to the sound.

8- Understand How to transform sound into electrical signal.

9- State the main characteristics of microphones.

10-Explain the principle of operation of various kinds of microphones and knowledge their characteristics, advantages, disadvantages and utilizations.

11-Understand How to transform electrical signal into sound.

12-State the principle characteristics of loudspeakers.

13-Explain the principle of operation of various kinds of loudspeakers and knowledge their characteristics, advantages, disadvantages and utilizations.

14-Use the separator filters in loudspeakers to determine the types of sounds.

15-Know the distribution of loudspeakers and couple them with transmission lines and amplifiers.

16-Know the different methods for sound reproduction.

17-Protect against noise in conference halls and theaters through the analysis and calculation of the reverberation time.

18-Distribute speakers in halls and theaters.

19-Understand the principle of operation and the connection of the equalizer and mixer through block diagrams.

20-Understand the steps of analog/digital conversion of audio signals.

21-Explain the recording and reading principle of CD players through block diagrams.

22-Understand the principles of the laser head and the tracking methods of the optical beam.

23-Explain the recording and reading principle of video disk player through block diagrams.

24-Explain the recording and reading principle of the flash memory.

***Teaching Method***

The purpose of the *audio visual systems I* course is to cover the basic information about the sound and to allow students the deep knowledge in the audio visual systems such as: Selection, connection and distribution of the microphones, loudspeakers in conference, music halls and theaters in addition to the protection against noise through the use of the isolation materials to decrease the effects of the echoes.

Another important side relates to reading and registration on CD, DVD and flash memory.

The methodology is to ensure the continuity between different elements in electronics (amplifiers, filters ,ect) and deal with the subject as follows:

1. Start with explanation of the sound and its propagation in different mediums, and determine its properties and characteristics.
2. State the different types of microphones and loudspeakers, show their characteristics, advantages, disadvantages, utilizations and connections

in conference and music halls and theaters.

1. Select and use mono, stereo and quadraphonic reproduction of the sound in many applications.
2. Treat the echoes in halls and theaters.
3. Build up the general block diagrams of the equalizer and mixer, give the role of each block and illustrate the electrical connections for each one.
4. Build up the block diagram of reading and recording of CD and DVD, give the role of each block and illustrate by drawing the optical head.
5. Build up the block diagram of reading and recording of the flash memory and give the role of each block.

The instructor should assist the students by presenting a real system and guiding them to ask questions in class. He should reinforce the concepts developed in the lectures by showing practical exercises and applications.

***Teaching aids***

* Overhead projector or power point on white board or active board with accessories.
* A notebook.
* A technical manual.
* A multi-media computer (if possible).
* Technical information documentaries (movies).
* Library access (guided if possible).

***Contents***

|  |  |
| --- | --- |
|  | **Hours** |
| 1. Sound properties. | 4 |
| 2. Microphone. | 8 |
| 3. Loudspeaker. | 8 |
| 4. Sound reproduction. | 4 |
| 5. Acoustics in Architecture***.*** | 8 |
| 6. Equalizer and mixer. | 4 |
| 7. Compact disc player. | 10 |
| 8. Video disc player. | 10 |
| 9. Flash memory. | 4 |
| **Total** | **60** |

**Skills:**

At the end of this part, the student will be able to:

1. Determine the properties and characteristics of sound.

2. Explain the operation and identify the various types of microphones and loudspeakers.

3. Connect the microphones, loudspeakers and cable in the audio systems.

4. Eliminate the echoes in conference halls and theaters.

5. Connect the equalizer and mixer in the audio systems.

6. Explain the conversion from analog to digital and from digital to analog for audio signal.

7. Show the parts of recording and reading block diagrams on CD and DVD.

8. Describe the steps of reproduction of CDs and DVDs.

9. Show the parts of recording and reading block diagrams on flash memory.

**Evaluation:**

The student will be evaluated according to:

1. Define the following: sound frequency, sound velocity, audio frequency wave forms, acoustic power of loudspeakers and musical instruments, band width.
2. List the various parts of microphones and loudspeakers, their characteristics; and describe their principle of operations. Deduce the use of microphones and loudspeakers in monophonic, stereophonic and quadraphonic systems.
3. Decrease echoes in conference halls and theaters.
4. Determine the isolation materials which are used in elimination echoes.
5. Determine the connection of equalizer and mixer in audio systems.
6. Knowledge all the used parts in recording and reading on CD, DVD and flash memory.

***Chapter 1:* *Sound properties (4 h)***

1. Mechanical properties of sound:

1.1. Vibration and displacement velocity of the particles.

1.2. Sound frequency.

1.3. Sound velocity.

1.4. Sonar wave forms.

1.5. Acoustic power of loudspeakers and musical instruments.

1.6. Band width.

2. Sound characteristics and audible frequency range:

2.1. Pitch.

2.2. Loudness.

2.3. Timbre (sound quality).

2.4. Noise analysis.

3. Music and speech.

***Chapter 2: The microphone (8h)***

1. Role of the microphone.

2. Main characteristics of a microphone:

2.1 Directivity: Omni-directional, uni-directional, bi-directional.

2.5 Frequency response.

2.6 Impedance.

2.7 Sensitivity.

3. Types of microphones:

3.1. Carbon microphone.

3.2. Electrostatic microphone.

3.3. Electrodynamic microphone.

3.4. Piezo-electric microphone.

3.5. Emitter microphone.

3.6. Sensors of guitars.

3.7. Ribbon microphone.

For each one: characteristics, composition, principle of operation, advantages and disadvantages, efficiency and domain of use.

***Chapter 3: The loudspeaker (8 h)***

1. Role of the loudspeaker

2. Main characteristics of a loudspeaker.

3. Types of loudspeakers:

3.1 Electrodynamic loudspeaker.

3.2 Electrostatic loudspeaker.

3.3 Piezo-electric loudspeaker.

For each one: characteristics, composition, principle of operation, advantages and disadvantages, efficiency, directivity and domain of use.

4. Distribution of loudspeakers: coupling with the amplifier:

4.1. Coupling at low impedance.

4.2. Coupling at high impedance.

4.3. Matching the impedances of loudspeakers with the transmission line.

4.4. Choosing the transmission lines for coupling the amplifier- loudspeaker.

5. Loudspeaker enclosure (loudspeaker cabinet).

6. Block diagram of the enclosures: control and role of each block.

***Chapter 4: Sound reproduction (4h)***

1. Mono reproduction.

1.1. Principle.

* 1. .Speaker arrangement in a single channel system.

2. Stereo reproduction.

2.1. Principle.

2.2. Speaker arrangement in a two-channel system.

3. Quadraphonic reproduction.

3.1. Principle.

3.2. Speaker arrangement in a four-channel system.

3.3. Ping pong effect.

3.4. Discrete system:

* Principle.
* Diagram of discrete sound using 4-channel open reel.
* Tapes and role of each part.
* Diagram of 4-channel eight-track tape cartridges for discrete sound and role of each part.

***Chapter 5: Acoustics in Architecture (8 h)***

5.1. Hearing.

5.2. Regulation.

5.3. Protection against noise.

5.4. Reverberation time.

5.5. Acoustic processing of halls.

5.6. Acoustic of different categories of conference halls:

5.6.1. Meeting hall.

5.6.2. Theaters.

5.7. Power calculation.

5.8. Exercises.

***Chapter 6: Equalizer and mixer (4 h)***

6.1. Equalizer block diagram and role of each block.

6.2. Band pass filter.

6.3. Sound volume definition.

6.4. Equalizer connection and testing.

6.5. Mixer block diagram: principle of operation and utilization.

6.6. Electrical connections.

***Chapter 7:* *Compact disc player (10h)***

* 1. Compact disc player:

7.1.1. Constitution.

7.1.2. The size and format of the disc.

* 1. .Principle of recording:

7.2.1. Block diagram of recording and function of each block.

7.3. Sampling:

7.3.1. Principle.

7.3.2. Waveforms.

7.4. Analog to digital converter:

7.4.1. Role.

7.4.2. Voltage to frequency converter:

7.4.2.1. Circuit.

7.4.2.2. Principle of operation.

7.4.3.3. Waveforms at the input and the output.

7.5. Digital to analog converter:

7.5.1. Role.

7.5.2. Binary weighted resistors (DAC).

7.5.2.1. Circuit.

7.5.2.2. Principle of operation.

7.5.2.3. Waveforms at the input and the output.

7.6. Disc fabrication.

7.7. Disc duplication.

7.8. Optical pick-up.

7.81. Principle.

7.8.2. Constitution of the optical section.

7.8.3. The objective lens drives construction.

7.9. The compact disc block diagram and the role of each block:

7.9.1. The main components of the CD block diagram:

7.9.1.1. Power supply.

7.9.1.2. CD running assembly.

7.9.1.3. Servo electronics: photodiode signal processor, radial

error processor, control processor.

7.9.1.4. Electronics decoder.

***Chapter 8:* *Video disc player*** *(****10h)***

8.1. Optical discs:

8.1.1. Principle.

8.1.2. Laser light beam.

8.1.3. Modulation techniques.

8.1.4. Block diagram of optical playback system and role of each block.

8.2. Capacitance discs:

8.2.1. Principle.

8.2.2. Spectrum of modulation frequencies.

8.2.3. Playback signal.

8.2.4. CED disc speed.

8.2.5. Tracking.

8.2.6. Groove lock.

8.2.7. VHD system.

8.3. DVD:

8.3.1. Constitution.

8.3.2. Block diagram of reading and recording on DVD and role of each block.

***Chapter 9*: *Flash memory (4h)***

9.1 Constitution.

9.2 Block diagram of reading and recording on flash memory.

9.3 Role of each block.