

VAN LANG UNIVERSITY
FACULTY: ARCHITECTURE

ANSWER KEYS FOR THE END-OF-COURSE EXAMINATION (FIRST TIME)
Semester 2 , Year 2022 - 2023

Course code: 233_72ARPH40433_01

Course name: Architectural physics 1

Group code: 72K27KTRU01

Duration (minute/day): 60 minutes

Format: Essay

How to submit (Lecturer gives clear requirements):

Suggestions:

- Students type directly in the submission box on the system:
- Students upload images (including charts, diagrams, and special formulas, **NOT** the lecture slides and word files)
- Students are permitted to use documents.

A1: (6 points).

M HSCSTN e	M ₁	M ₂	M ₃	M ₄	M ₅
e ₁	20	12	11	8	7
e ₂	93	78	61	47	41
e	18,6	9,36	6,71	3,76	2,87

A2: (4 points)

Reverberation time is a criterion for evaluating sound quality in an auditorium, and is the basis for deciding the shape and size of the auditorium. Depending on the function of the auditorium, there is a required reverberation time. When calculating, the reverberation time should be longer than required so that when put into use, a change in the sound absorption coefficient will make the reverberation time more reasonable.

Rooms with different functions will have different reverberation time requirements.

Determine the reverberation time as the time required for the sound pressure level of a certain frequency at a standard steady state of 60dB to decrease until it is no longer audible (0dB). In rooms with the same amount of sound absorption $A = S \cdot \bar{\alpha}$, the room with the larger volume has the longer reverberation time, the reason is that the large volume room

has a long reflected sound path, the number of reflections in a single unit. The less time it takes, the longer the sound energy fades, the longer the reverberation time. Therefore, the reverberation time is the basis for determining the dimensions of the surfaces in the auditorium.

The shape and size of an auditorium have a significant impact on the sound design and acoustics of the space. Here are some key ways that the auditorium's geometry affects the sound:

- Room Dimensions:

Volume and dimensions of the auditorium determine the room's natural resonant frequencies.

Larger rooms tend to have lower resonant frequencies, which can amplify low-frequency sounds.

Appropriate dimensions help achieve a balanced frequency response across the audible range.

- Room Shape:

The shape of the auditorium (e.g., rectangular, fan-shaped, shoebox) affects sound reflection patterns.

Rectangular rooms can create flutter echoes, while fan-shaped rooms may have focusing effects.

Irregular shapes can help diffuse sound and reduce problematic reflections.

- Ceiling Height:

Ceiling height influences the room's reverberation time, which is the time it takes for sound to decay.

Higher ceilings generally result in longer reverberation times, which can enhance the sense of spaciousness but may also cause excessive echo.

Careful tuning of the reverberation time is crucial for speech intelligibility and musical clarity.

- Stage Geometry:

The size and configuration of the stage affect how sound is projected into the audience area.

Shallow stages may create a disconnect between the performers and the audience.

Proper stage design, including the use of reflective surfaces, can help enhance the acoustic coupling between the stage and the auditorium.

- Audience Seating:

The arrangement and density of the audience can influence the room's acoustic behavior.

Densely packed audience absorbs more sound, reducing the overall reverberation time.

Seating layout can also affect sound reflections and create potential problem areas, such as dead spots.

To address these acoustic challenges, sound designers may employ various strategies, such as acoustic treatment materials, sound-reflecting surfaces, and electronic sound reinforcement systems. The goal is to create an optimized acoustic environment that supports the intended use of the auditorium, whether it's for music performances, lectures, or other events.

Ngày biên soạn: 8/05/2024

Giảng viên biên soạn đáp án đề thi: Th.S KTS Nguyễn Thị Việt Hà

Ngày kiểm duyệt:

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