2026 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test Question Sheets

Examination Subject
Media Engineering

[Compulsory Question] Answer the Question below.

The following are terms used in the field of Media Engineering (Image Information Processing, Image Analysis Technology, Web Informatics, Computer Graphics, Virtual Reality, and Mechanics Design).
Select six of the following 19 technical terms in the field of Media Engineering, and explain each.
[60 points, 10 points each]

(1) Grayscale image
(2) Fourier transform
(3) Histogram
(4) Highpass filter
(5) Median filter
(6) Gamma correction
(7) Generalized cylinder method
(8) Echo Chamber
(9) PageRank
(10) Word2Vec
(11) Collision Detection
(12) Crowd (flock) Simulation
(13) Differentiable Rendering
(14) Social VR
(15) Nonverbal communication
(16) VR sickness
(17) Polar moment of inertia of area
(18) Aronhold-Kennedy theorem of three centers
(19) Involute curve

This question evaluates the candidate's ability to provide clear explanations of the fundamental concepts behind key terms essential for a cross-disciplinary understanding of media engineering at the beginning of their master's research. Responses are expected to demonstrate appropriate terminology selection and a logical, well-organized structure.

[Elective questions]

Choose and answer two questions from the following questions 1 through 6.

Elective Question 1 [70 points]

[1] Answer the following questions about the image filtering process. [40 points]

1. Figure 1 shows a model of the process of generating a degraded image by the PSF (point spread function) as a result of mask processing. Let $f_{ij}(i=0,1,\cdots,N;j=0,1,\cdots,N)$ be the image before the processing, $h_{kl}\,(k=\text{-}m,\cdots,\text{-}1,0,1,\cdots,m\,;\,l=\text{-}n,\cdots,\text{-}1,0,1,\cdots,n)$ be a linear mask that represents the PSF, and g_{ij} be the resulting image processed by the mask. Express g_{ij} in terms of f_{ij} and h_{kl}. Where, the processing is assumed to be performed within the range of the image where the entire mask fits. (20 points)
2. Answer the general name of the arithmetic process expressed in 1. (10 points)
3. Explain the filters used to sharpen or blur an image. (10 points)

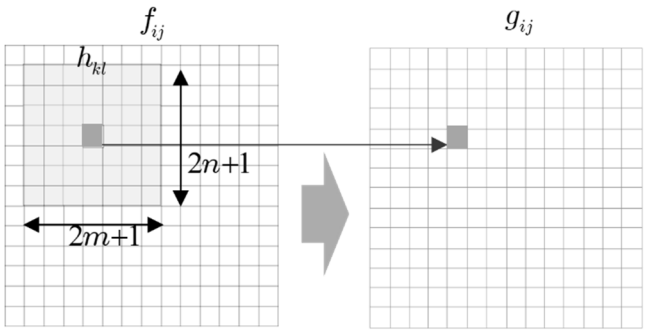

Figure 1: Image processing by a linear mask.

[2] Answer the following questions about geometric transformations of images. [30 points]

1. Shifting, scaling, and rotating an image can be accomplished by a linear transformation. Give the general name of this linear transformation and the transformation formula, where $(x,\ y)$ be the coordinate system before the transformation and $(u,\ v)$ be the coordinate system after the transformation. (20 points)
2. In the geometric transformation of a digital image, interpolation is necessary to obtain the value of each pixel that forms the image after the transformation. List two typical interpolation methods in image processing. (10 points)

[1] This question evaluates knowledge and understanding of the relationship between image masking and convolution processing, as well as filtering, which is a fundamental operation in image processing.
[2] This question evaluates knowledge and understanding of geometric transformations applied to images represented in a

Elective Question 2 [70 points]

[1] Show 16 possible labelings of vertices in the trihedral world. [35 points]

[2] Give one example of a line drawing that can be labeled under the trihedral world but does not exist as a real-world three-dimensional object. [35 points]

[1] This question examines basic knowledge related to line-drawing interpretation.
[2] This question examines fundamental understanding of line-drawing interpretation.

Elective Question 3 [70 points]

[1] Information Recommendation [30 points]

[Q1] Explain the basic concepts, advantages, and disadvantages of collaborative filtering and content-based filtering in recommendation systems. (20 points)

[Q2] A recommendation model suggested 5 items to a user, of which 2 were items the user was actually interested in. The user was interested in 4 items in total. (10 points)
Answer the following:

1) Calculate Precision@5.
2) Calculate Recall@5.

[2] Large Language Models [40 points]

[Q1] What is a Large Language Model (LLM)? Explain its basic architecture and training method. (10 points)

[Q2] Explain why prompt design is important in LLMs such as ChatGPT and give one example of prompt engineering. (15 points)

[Q3] What is Retrieval-Augmented Generation (RAG)? Explain its mechanism and describe its advantages compared to traditional LLM-based text generation. (15 points)

[1] [Q1] This question assesses whether students can correctly understand and clearly distinguish between two major approaches to recommendation systems, collaborative filtering and content-based filtering, and explain their respective strengths and weaknesses in a balanced manner.
[Q2] This question checks whether students understand and can calculate basic metrics used to evaluate recommendation list quality.
[2] [Q1] This question assesses understanding of the basic architecture of LLMs (especially Transformer-based models) and the flow of pretraining. It evaluates whether the student has a good grasp of the overall structure of LLMs.
[Q2] This question tests understanding of how prompt design affects output and whether the student has practical skills in interacting with LLMs effectively.
[Q3] This question checks understanding of Retrieval-Augmented Generation (RAG), a key extension of LLMs that addresses the challenge of limited internal knowledge. It evaluates how students grasp the use of external information sources.

Elective Question 4 [70 points]

Read the following passage and answer questions 1 to 3.

Physically-Based Rendering is primarily aimed at generating photorealistic computer-generated imagery and is often referred to as photorealistic rendering. In contrast, Non-Photorealistic Rendering (NPR) refers to a broad range of techniques used to generate non-photorealistic images.

1. Among the major approaches in NPR is the simulation of traditional artistic rendering techniques. There are two main categories within this approach. Briefly describe what these two categories are. [10 points]
2. Typical inputs to NPR methods include images, 3D models or scenes, and user-drawn strokes. Taking these types of input into account, list as many specific research topics in NPR as possible. [30 points]
3. Describe an algorithm that generates an oil painting–style NPR image from an input image, using either pseudocode or a numbered list. [30 points]

1. Purpose of the question: To assess understanding of the general framework of NPR research.
2. Purpose of the question: To assess familiarity with actual NPR research examples.
3. Purpose of the question: To assess the ability to describe algorithms and basis of NPR algorithms.

Elective Question 5 [70 points]

[1] Answer the following questions concerning stereoscopic vision and depth perception enabled by Head-Mounted Displays (HMDs). [70 points]

a) List one major hardware component for each of the following functions necessary to achieve stereoscopic (3D) perception in a head-mounted display (HMD): image display, disparity generation, and viewpoint tracking. For each component, explain its role in enabling the corresponding function. (30 points)

b) Explain the geometric principles underlying binocular disparity (stereopsis). Additionally, describe how it contributes to human depth perception, providing specific examples. (20 points)

c) In addition to binocular disparity, list at least five monocular (pictorial) cues that contribute to the perception of three-dimensional space in a VR environment. For each cue, explain how it contributes to depth perception. (20 points)

[1] This question set aims to evaluate whether the student has a well-rounded understanding of the mechanisms of stereoscopic vision and depth perception in HMDs, from technological and perceptual perspectives. The questions progress from basic knowledge of device structure to perceptual principles like binocular disparity and monocular depth cues, enabling assessment of both foundational understanding and broader conceptual application.

a) This question assesses the student's ability to accurately describe the technical components—such as displays, optical lenses, and tracking sensors—that support stereoscopic vision in HMDs. Understanding the device's internal structure is essential as a foundation for VR; students are expected not only to name each component but to explain how they collectively produce binocular disparity and enable head-tracked viewpoint updates.

b) This question evaluates the student's understanding of the perceptual mechanism of binocular disparity. The student should demonstrate awareness of how the geometrical relationship between disparity and depth allows the brain to reconstruct spatial information from two slightly different images.

c) This question tests the student's knowledge of depth cues that work independently of binocular vision, such as occlusion, perspective, and shading. Recognizing these cues demonstrates an understanding of how visual realism and convincing spatial perception can be achieved in VR even when binocular disparity is limited or absent.

Elective Question 6 [70 points]

[1] Answer the following questions regarding the design of engineering function. [30 points]

1) Explain the Delphi method, which is a forecasting technique and consensus-building method, including its characteristic concepts, implementation methods, and points to note during implementation. (15 points)

2) Explain the distinctive concepts of TRIZ, a theory for solving design problems, how to use it, and the type of thinking required of users in order to utilize it. (15 points)

[2] The speed at which raindrops fall will be discussed based on dimensional analysis and experimental data, treating raindrops as spherical masses of water. Answer the following questions. [40 points]

1) Assuming that the air resistance D experienced by a sphere in motion depends on the diameter of the sphere d, the velocity of the incoming flow to the sphere V, and the density of the air ρ, express the relationship between these variables using a single dimensionless parameter k in the form $D = k\, d^{a} V^{b} \rho^{c}$. Find the values of a, b, and c. (15 points)

2) Within the range assumed for the falling velocity of raindrops, when the value of parameter k in 1) can be set to a constant value of 0.1, calculate the drag force D exerted by the air on a spherical water droplet with a diameter of 1 mm falling at a velocity of 2.0 m/s, specifying the units. Assume that the water droplet retains its spherical shape regardless of the force exerted by the air. The density of air is assumed to be 1/800 of the density of water at a standard temperature. (10 points)

3) After a while after the water droplet in 2) began to fall in still air, its speed became constant. Calculate the constant speed V_t at this point. Let the gravitational acceleration be g, and use appropriate approximations such as $\pi \approx \sqrt{g}$ in your calculations. (15 points)

[1] This question tests knowledge of major methods used to conduct design-related research reliably and effectively, and to solve design problems by leveraging prior knowledge. It focuses on basic concepts, the properties of these methods, and key points for using them successfully.

[2] This question is intended to confirm the candidate's ability to perform a series of processes using dimensional analysis, a fundamental method for identifying the characteristics and degree of contribution of key factors in physical phenomena, extracting essential features from experimental results, and efficiently organizing them for use. The task ranges from modeling familiar phenomena to calculating specific numerical values based on the results. It also evaluates whether the candidate possesses knowledge of basic physical property values.