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

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[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)

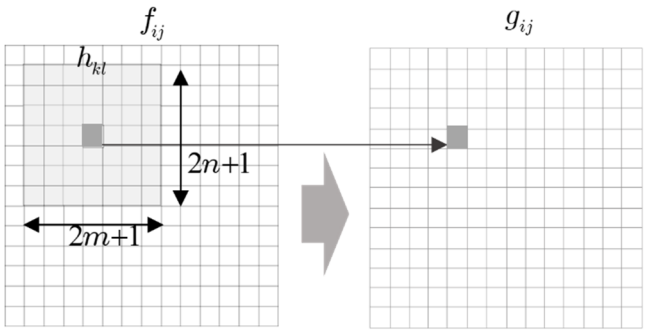

Figure 1: Image processing by a linear mask.

[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)

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]

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)

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]

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)

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)

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No._____ technical term_____

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No._____ technical term_____

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