2024 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test Question and Answer Sheets

Examination Subject
Human Life Design and Science

Examinee's number

In addition to the following two required questions (100 points in total), select two elective questions from page 3 to page 16 (50 points each), and answer four questions in total.

< Required Question – 1 >

Select three terms from the following keyword group and discuss the relationship between our human society, where artificial intelligence (AI) is becoming a social infrastructure, and human life in about 400 words, mentioning each of the three words selected. In your answer, underline the three words you selected. <60 points>

Keyword Group: Cognitive Function, Creativity, Elderly, Public Relations, Simulation, Science and Technology, Creative Activity, Universal Design, Environmental Adaptability

< Required Question – 2 >

Select five terms from the following keyword group and explain each in about 40 words <40 points, 8 points each>

Non-visual Effects of Light; Tacit Knowledge; Human Error; Image Hump; Neurotransmitter; Social Identity and Intergroup Relations; Necessary Activities/Optional Activities; Induction; Brown Adipose Tissue; Bayesian Inference; Procedural Justice; Screw; Bohr Effect; International Classification of Functioning, Disability and Health (ICF); Creative Direction of Advertising; Ordinary Differential Equation; Type of Gear; Branded Entertainment

Selected Keyword 1 [ ]

Selected Keyword 2 [ ]

Selected Keyword 3 [ ]

Selected Keyword 4 [ ]

Selected Keyword 5 [ ]

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< Elective Question – 1 >

Explain the concept of 'social jetlag' based on its root causes, describe the health implications, and the physiological mechanisms behind it. Lastly, propose possible solutions or strategies to mitigate its effects. (at least 250 words) <50 points>

< Elective Question – 2 >

Inclusive design is a concept that aims to design products that are inclusive of previously excluded user groups and still work well as a business. Please answer the following questions about inclusive design. <5 points + 15 points + 30 points = 50 points>

1) Describe the difference between universal design and inclusive design. <5 points>

2) What process do you consider important for the process of designing a business-viable design? Please explain using the terms "scenario" and "extreme user." *Extreme users here mean "users with extreme characteristics and thoughts that are not common. <15 points>

3) If you were to design a new cookware using the inclusive design concept, which extreme user would you choose to design it for? Also, please share your thoughts on why you would do so. <30 points>

< Elective Question – 3 >

Outline the mechanism of flexion and extension in the elbow joint, mentioning the roles of skeletal muscles and joint structure. (at least 250 words) <50 points>

< Elective Question – 4 > (You may also use the following sheet to answer. Do not use the back side.)

Let $\boldsymbol{x}(t) = \begin{pmatrix} x_1(t) \\ x_2(t) \end{pmatrix}$ be a two-dimensional real function of a real variable t, and it satisfies the following differential equation

$$\frac{d\boldsymbol{x}(t)}{dt} = A\boldsymbol{x}(t), A = \begin{pmatrix} 3 & 1 \\ 1 & -3 \end{pmatrix} \quad \cdots (\star)$$

Answer the following questions. <50 points>

(1) One of the solutions of Equation $(\star)$ can be written as

$$\boldsymbol{x}(t) = \boldsymbol{v}e^{\lambda t},$$

where λ and $\boldsymbol{v}$ are a real variable and a two-dimensional real vector, respectively. Derive an equation that λ and $\boldsymbol{v}$ should satisfy and is independent of t.

(2) An infinite number of pairs $(\lambda, \boldsymbol{v})$ satisfy the equation in the previous question. Find two solutions of the equation that have different values of λ.

(3) Let the two pairs of $(\lambda, \boldsymbol{v})$ derived in the previous question be $(\lambda_1, \boldsymbol{v}_1)$ and $(\lambda_2, \boldsymbol{v}_2)$. The general solution of Equation $(\star)$ can be written as

$$\boldsymbol{x}(t) = \alpha_1 \boldsymbol{v}_1 e^{\lambda_1 t} + \alpha_2 \boldsymbol{v}_2 e^{\lambda_2 t},$$

where α_1, α_2 are arbitrary constants. Find the solution of Equation $(\star)$ for $\boldsymbol{x}(0) = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$.

(4) Find the initial condition under which the function $\boldsymbol{x}(t)$ converges when limit $t \to \infty$.

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< Elective Question – 4 > answer sheet (continued)

Do not write on the back side of the answer sheet, or your answers will not be marked.

< Elective Question – 5 >

Please describe your views on the discourse that "advertising sponsors use adverts and public relations properly," with specific examples.
<50 points>

< Elective Question – 6 >

State three reasons why fall-prevention is important for the elderly. In addition, elaborate on the risk factors that contribute to falls from various perspectives. (at least 250 words) <50 points>

< Elective Question – 7 > (You may also use the following sheet to answer. Do not use the back side.)

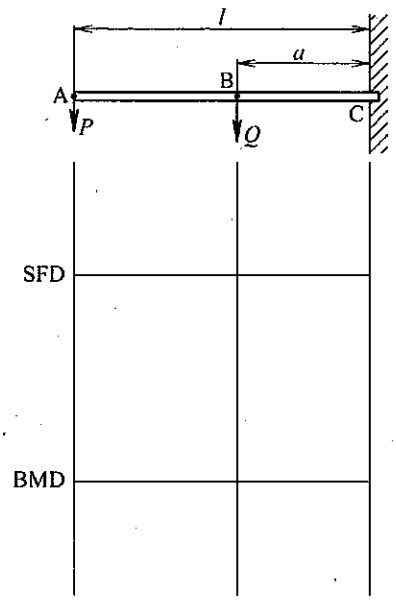
The designed exhibition stand was modeled as a beam as shown in the figure. Fix one end C of the beam, and hang works with weights P and Q at points A and B, respectively. The length of the beam is as shown in the figure. Answer the following questions. Note that modulus of longitudinal elasticity (Young's modulus) is E, the cross-sectional area is A, the moment of inertia of area is I, and the section modulus is Z (not all of these variables may be necessary for the answer). In addition, neglect the weight of the beam. <50 points>

(1) Determine the size of the reaction force R_C at point C and its direction.

(2) Draw the shearing force diagram (SFD) and bending moment diagram (BMD). Determine the maximum bending moment M_{max} between A and C. In addition, show the derivation process.

(3) Determine the maximum stress σ_{max} in the beam and its location with as much detail as possible.

(4) Determine the downward deflection δ_A at the point A. Here, the deflection and the slope at the tip of the cantilever beam when the concentrated load P is acting at the tip of a cantilever beam of length l are $Pl^3/3EI$ and $Pl^2/2EI$, respectively.



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< Elective Question – 7 > answer sheet (continued)

Do not write on the back side of the answer sheet, or your answers will not be marked.

< Elective Question – 8 >

You have a plan to conduct research on human sleep quality by carrying out the measurement of brainwaves. Explain the experimental design and steps you would need to implement to achieve this objective. (at least 250 words) <50 points>

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< Elective Question – 9 >

Elaborate on the mechanism by which sweating occurs. In addition, discuss the advantages and disadvantages of the effects of sweating in relation to body temperature regulation. (at least 250 words) <50 points>

< Elective Question – 10 >

Using the following experiment overview and results as clues, answer questions (1) through (3) regarding rule design and behavior change. <50 points>

*The description is omitted. All experiments, including the selection of the subject population, are properly conducted and the results are significant.

<Experiment overview> Subjects were asked the following two questions.

Question 1: Which of the following two options, 1a and 1b, would you choose?

Option 1a: You get 100,000 yen unconditionally.

Option 1b: You draw a lottery with a probability of 1/2 so that you will receive 200,000 yen or nothing.

Question 2: Which of the following two options, 2a and 2b, would you choose?

Option 2a: 100,000 yen will be forfeited unconditionally.

Option 2b: You draw a lottery with a probability of 1/2 so that 200,000 yen will be forfeited, or 100,000 yen will be exempted from forfeiture.

<Results> The tendency of subjects' responses to questions 1 and 2 above was as follows.

Question 1: Most subjects chose Option 1a.

Question 2: Almost all subjects who selected Option 1a in Question 1 selected Option 2b.

(1) Select and circle two appropriate human characteristics that can be derived from the interpretation of the above experimental results.

A. When faced with a profitable choice, people tend to take risks to maximize the profits.
B. When faced with a profitable choice, people tend to be risk averse and fix their profits.
C. People always tend to choose to maximize their expected utility.
D. When faced with a choice that leads to a loss, people tend to try to avoid the loss, even if it means taking a risk.
E. When faced with a choice that leads to a loss, people tend to be risk averse and seek to fix the loss.
F. People overestimate low probability events and underestimate high probability events.

(2) Based on your answer to (1), propose one rule that could induce a change in human behavior. Specify the expected behavior change and indicate why you believe the rule is effective.

Expected behavior change:

Proposing rule:

Reason:

(3) In the case that the rule proposed in (2) was not effective in changing the expected behavior, give possible reasons for the result.

< Elective Question – 11 >

Street furniture such as benches and lighting consist of ready-made products and custom-made products. Compare ready-made products and custom-made products and discuss the advantages and disadvantages of each product. <25 points + 25 points = 50 points>

Advantages of ready-made products when compared to custom products	
Disadvantages of ready-made products when compared to custom-made products	

Advantages of custom products when compared to ready-made products	
Disadvantages of custom products when compared to ready-made products	

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< Elective Question – 12 >

Describe the principles of Allen's and Bergmann's rules. Discuss and justify, including the reasoning, whether or not these rules hold true for modern humans. (at least 250 words) <50 points>