2023 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test Question Sheets

Examination Subject

Architectural Engineering and Environmental Chemistry

Question 1

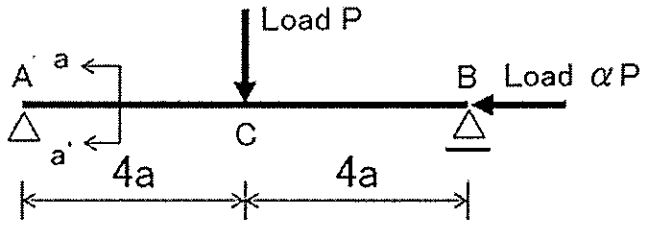
Describe each of the following 20 keywords related to environmental design. (5 points × 20 questions)

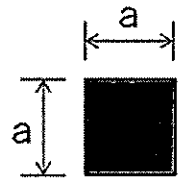
(1) Affordance
(2) Neighborhood unit
(3) La Ville Radieuse
(4) Functionalism
(5) Conventional wood-framed construction
(6) DX (Digital Transformation)
(7) Vegetation of Japan
(8) Garden city
(9) City park／Urban park
(10) Resilience
(11) Plywood
(12) Vibration control of buildings
(13) Air pollutants
(14) Thermal transmittance
(15) ZEB (Net Zero Energy Building)
(16) SDGs (Sustainable Development Goals)
(17) Gothic Revival
(18) Globalization
(19) Tatami mat
(20) Renaissance

* Select and answer two questions from among Question 2 to Question 5. If more than three questions are answered, they will not be marked.
* When answering the questions, use a separate answer sheet for each question. Each answer should be kept on a single sheet. The first question of your choice must be answered on the third sheet of the answer sheets and the second question on the fourth sheet of the answer sheets.

Question 2: Answer the following questions on Structural Engineering.

Answer (1) through (3) for the simple beam shown in the figure below.





Cross section a-a'

(1) Calculate the bending moment and the axial force at point C. (10 points)

(2) Calculate the maximum and the minimum normal stress at the cross section of point C, where tensile stress is positive and compressive stress is negative, and $\alpha>0$. (20 points)

(3) Calculate the maximum load P when normal stresses obtained in question (2) satisfy compressive stress $\sigma_c \geq -f$ and tensile stress $\sigma_t \leq f/10$. In addition, draw the stress distribution in depth at the cross section of point C when the maximum load P occurs, where tensile stress is positive and compressive stress is negative, and $\alpha>0$. (20 points)

Question 3: Answer the following questions on Building Materials.

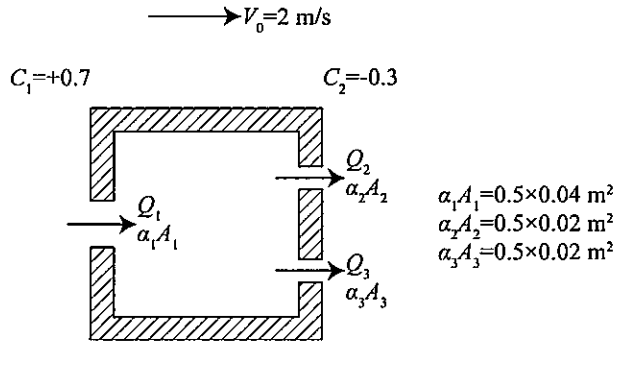
(1) Give the characteristics of specified concrete mix that lead to large drying shrinkage cracks and two methods to reduce drying shrinkage. (15 points)

(2) Explain how the strength and dimensions of wood used as a structural material change with moisture content. (15 points)

(3) Explain the changes in tensile strength, elongation, Young's modulus, and yield point of steel that occur at high temperatures, which are the basis for the need for fire-resistant coatings on major structures such as columns and beams in steel structures. In particular, show the trend of changes around 250-300°C. (20 points)

Question 4: Answer the following questions on Environmental Engineering.

(1) The building shown in the diagram below is provided with wind-powered ventilation only. Calculate the airflow rate. Assume that external wind speed is 2.0 m/s, wind pressure coefficient on the windward side is +0.7, wind pressure coefficient on the leeward side is -0.3, and air density is 1.2 kg/m³. The square root may be left as it is. (15 points)



(2) Answer six factors that influence thermal comfort, and explain WBGT that is used to assess heatstroke risks in summer. (15 points)

(3) Explain the inverse square law of sound and illumination from the aspect of geometry. (10 points)

(4) Explain traps in drainage systems. In addition, explain drying out of traps. Diagrams may be used if necessary. (10 points)

Question 5: Answer the following questions on Environmental Chemistry.

(1) Explain the definition and the generation mechanism of micro plastics, and the damages being concerned and countermeasures being taken. (15 points)

(2) There are various substances that cause allergies in the indoor environment. Explain what kind of substances there are. (20 points)

(3) Describe the name of the substance that caused Kanemi Yusho Disease, and explain the reason why it happened. (15 points)