

Entrance Examination for 2022 Master's Program
Specialized Engineering Knowledge
(Question Abstract)

[Structural Mechanics]

Considering a two-dimensional beam structure with multiple concentrated loads, draw the axial force diagram, the shear force diagram and the bending moment diagram, and find the displacements at the designated position of the structure. In addition, restraining a displacement at a certain position of the structure, find the reaction forces at that point.

When a simply-supported beam CD with a span L subjected to a concentrated load P is located on a simply-supported beam AB with a span $4L$, find the reaction forces at points A and B. One point is supposed to be located on the beam AB with a certain distance from support A. Using influence lines method, find the position of support C and the maximum bending moment at this point, when the bending moment at this point shows the maximum value. According to the above results, find the maximum bending moment and its position of the beam AB.

[Hydraulics]

Derive the basic equation of Hagen–Poiseuille flow from the Navier–Stokes equation in the cylindrical coordinate system and show a velocity distribution in the flow. Derive the equation of water–surface profile in a channel with uniform cross-section, consider the water–surface profile of a mild slope channel, and consider the group velocity and dispersibility of water surface waves.

[Soil Mechanics]

In the sand and clay layered ground, the porosity and effective stress distribution are obtained, and the subsidence due to pumping up groundwater from the sand layer is calculated. Terzaghi's failure mechanism and bearing capacity formula for the belt-shaped foundation are asked, the allowable bearing capacity is required to introduce from the limit bearing capacity, and the principle of ground improvement is asked when the bearing capacity is insufficient.

[System Analysis for Planning and Management]

The first question relates to a three-step dynamic programming problem, which is formulated using a dynamic programming equation to find a solution. The second question relates to a multiple regression analysis considering the statistical significance of each coefficient and the model fitness from the estimation result.