Entrance Examination for 2024 Master's Program
Specialized Engineering Knowledge
(Question Abstract)

[Structural Mechanics]

As for the simply supported bent beam with a right angle at the span center and with overhangs subjected to an external force, calculate the reaction forces and draw the sectional force diagram of the axial force, shear force and bending moment. In addition, explain the procedure to find the beam deflection of simply supported span by indicating the governing equations with necessary boundary conditions and continuity conditions. Furthermore, by adding a reinforcing member to make the beam statically indeterminate in order to suppress deflection, find the sectional force of added reinforced member.

[Hydraulics]

Question 1 is about the derivation process of the log-law for the flow velocity distribution near the channel bed using the mixing-length hypothesis and the velocity distribution for the viscous sublayer in the very vicinity of the channel bed. Question 2 is about the derivation process of the equation for the water surface profile from the equation for the one-dimensional gradually varied flow with steady condition in an open channel and the derivation process for the equation for the conjugate depth that relates to a hydraulic jump using a specific force.

[Soil Mechanics]

In Question 1, the coefficient of consolidation, coefficient of volume compressibility, hydraulic conductivity are determined from a consolidation test on a soil sample taken from a saturated homogeneous clay layer, and the consolidation settlement of the clay layer is determined. In Question 2, the distribution of earth pressure and the resultant force acting on the earth retaining wall are obtained for excavation problem in sandy soil, and the stability of the earth retaining wall with respect to overturning is discussed.

[System Analysis for Planning and Management]

The first question is about linear programming with inequality constraints. The questions include the formulation of the problem and its dual problem, the derivation of the optimal solution by the simplex method, and the range of constraints under which the optimal solution does not change.

The second question relates to PERT (Program Evaluation and Review Technique) finding the critical path and expected duration of the construction project shown by the arrow diagram, and CPM (Critical Path Method) identifying the necessary minimum extra cost, the activities and their number of days to be crashed.