[File upload] <u>ftp://cdl.hanyang.ac.kr</u> → cdl/cdl → 차제구조 → Lab_final_exam [analysis_result_file] (학번)_(문제번호) ex) 2000100100_1 [report_file] (학번) upload only one file for all problems.

1. [Frequency Response] For the alloy steel beam with boundary conditions shown, perform the frequency response analysis and answer the following questions. Use 1-D beam element. (30 pts)



Problem	Loading condition	Amplitude	Direction	Frequency range	Resonance bands	Discussion
(a)	Case 1	1 N	Y-axis	0~3,000 Hz		Explain why different
(b)	Case 2	1 N	Z-axis	0 ~ 3,000 Hz		resonance bands are appeared.

2. [Size Optimization] Find optimal section parameters (beam radius) of the frame structure. Use the following formulation. (35 pts)



3. [Topology Optimization] Here is a bridge design example. The following figures show the design domain, non-design domain and the loading conditions for the structural design. Obtain a conceptual design using topology optimization method. The optimization problem is formulated to minimize the mean compliance with 0.5 volume fraction. Use 2-D shell elements of which the length is 2 mm and the thickness is 5 mm.



Explain why the topology results of two loading cases are different. (35 pts)