Notes: 1. Any missing data is to be reasonably assumed.
2. Design Aids can be used.
3. The Exam consists of 2 pages.

Question 1: (50%)

The given plan shows the layout of a roof system. The part of the roof between axis 5-5 and axis 7-7 (including the cantilever) is to be designed as hollow-block slabs using hidden beams system. The design concrete characteristic strength is equal to 30 MPa and the main steel used is 360/520. The height of the story is 4.25 m. The live load is 8.50 kN/m^2 and the flooring cover is 2.00 kN/m^2. It is required to:

1- Design a two way hollow-block slabs for the part of the roof between axis 5-5 and axis 7-7 using Hagarit blocks of dimensions 20x20x40 cm. Draw to a suitable scale the details of reinforcement of the slabs. (15 %)

2- Design the hidden beam on axis 7-7 and draw to a suitable scale the details of reinforcement of this beam. (10 %).

3- If the part of the roof between axis 1-1 and axis 4-4 is to be designed as continuous paneled beams, it is required to design the most critical paneled beam. Draw to scale 1:100 the details of reinforcement of this beam. (15%)

For a hinged-fixed beam: $\dfrac{\delta_h}{\delta_{max}} = \dfrac{185}{48} \left\{ \dfrac{x}{L} - 3\left(\dfrac{x}{L}\right)^3 + 2\left(\dfrac{x}{L}\right)^4 \right\}$

For a fixed-fixed beam: $\dfrac{\delta_f}{\delta_{max}} = 16\left(\dfrac{x}{L}\right)^2 \left\{ 1 - 2\left(\dfrac{x}{L}\right) + \left(\dfrac{x}{L}\right)^2 \right\}$

4- In one of the spaces, arrange a cantilever stair consisting of two flights. The width of the step is 2.15 m. Design the stair and draw the reinforcement details. (10 %)