

Name and surname of the applicant (in block letters) : .....

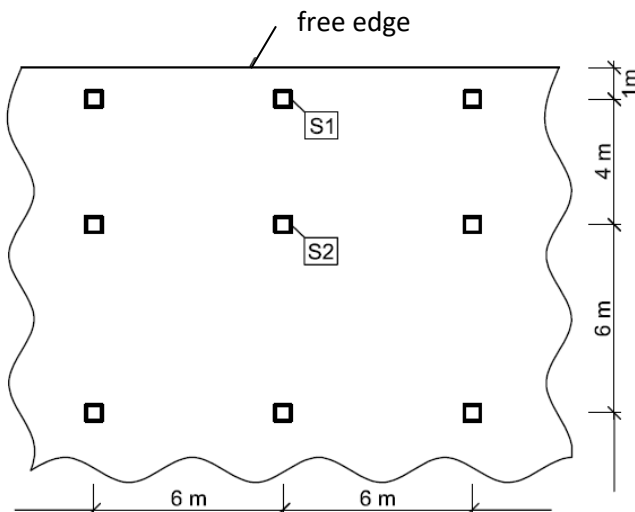
Numeric application code: .....

Guidelines for completion of test:

- On each page, fill in your name and your application code
- Each question has four answers while only one answer is correct.
  - Marked correct answer means 4 points
  - Marked incorrect answer means -1 point
  - Unmarked answer means 0 points.
- Correct answer shall be marked with a cross across the letter indicating the correct answer.
  - To undo the crossed answer, draw a circle around the crossed letter.
  - Other ways of marking the answer are considered incorrect (-1 point)
- Duration of the test is 90 minutes.

The exam questions:

- 1) Determine the characteristic value of axial force at the base of the internal reinforced concrete column S2. Consider the loading from one floor (self-weight, live load, dead load). The influence area of column is defined by the mid-span of adjacent spans. The density of reinforced concrete is  $25\text{kN/m}^3$ .



- Depth of RC slab :  $h_d = 240 \text{ mm}$
- Other dead load:  $(g - g_0)_k = 2 \text{ kN/m}^2$
- Live load:  $q_k = 3 \text{ kN/m}^2$
- Column dimension:  $400 \times 500 \text{ mm}$
- Column height:  $h = 3.0 \text{ m}$

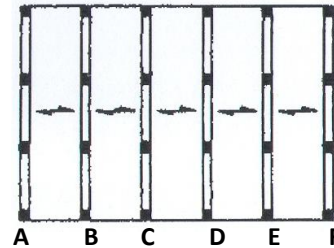
- [ A ] 165 kN
- [ B ] 285 kN
- [ C ] 345 kN
- [ D ] 660 kN

Name and surname of the applicant (in block letters) : .....

Numeric application code: .....

2) 4-storey RC in-situ frame system (uniformly distributed load in all spans + wind load parallel to the frames' plane); spacing of frames is even, columns and beams have constant sections. Compare values of loading for edge frame A and inner frame B:

- [ A ] Both vertical load and wind load are bigger for frame B than for frame A
- [ B ] Both vertical and horizontal load are the same for both frames
- [ C ] Vertical load is same for frame A and B, wind load is bigger for frame B
- [ D ] Vertical load is bigger for frame B, wind load is the same for both frames



3) What does the creep of concrete mean?

- [ A ] The increase in strain with time resulting from the drying of concrete
- [ B ] The increase in strain with time resulting from long-term sustained load
- [ C ] The decrease in stress in concrete with time resulting from the constant deformation
- [ D ] The decrease in compressive strength of concrete with time due to concrete aging

4) The effect of corrosion induced by carbonation does not have to be considered for:

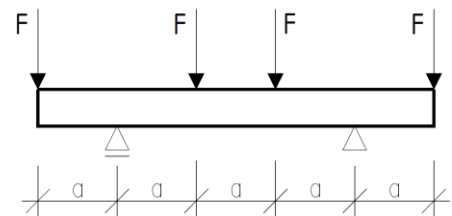
- [ A ] Plain concrete
- [ B ] Reinforced concrete
- [ C ] Pre-stressed concrete
- [ D ] Steel fiber reinforced concrete

5) What does the water to cement ratio mean?

- [ A ] The weight ratio of the amount of water to the amount of cement
- [ B ] The volume ratio of the amount of water to the amount of cement
- [ C ] The volume ratio of the amount of water to the amount of concrete
- [ D ] The weight ratio of the amount of cement to the amount of concrete

6) The overhanging under-reinforced concrete beam is subjected to point loads "F" (see picture). The first flexural cracks are expected to occur:

- [ A ] At the midspan of the beam
- [ B ] Over the supports of the beam
- [ C ] Over the supports and at the midspan of the beam at the same time
- [ D ] At the beam ends



7) Which of the following loading fits into the group of permanent loads?

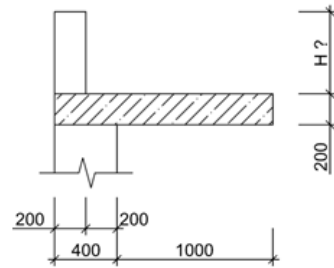
Name and surname of the applicant (in block letters) : .....

Numeric application code: .....

- [ A ] Self-weight
- [ B ] Snow load
- [ C ] Wind load
- [ D ] Live load (imposed load)

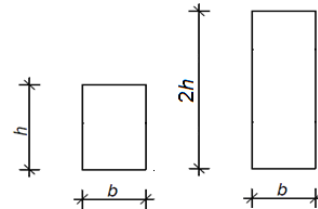
8) Determine the minimum height  $H$  of the attic to ensure the stability of the reinforced concrete awning (consider only the self-weight of the structure). The density of both materials is  $2500 \text{ kg/m}^3$ ; all safety factors equal to 1.

- [ A ] 800 mm
- [ B ] 1000 mm
- [ C ] 1200 mm
- [ D ] 1400 mm



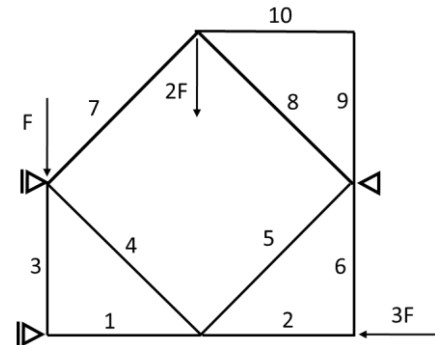
9) The flexural capacity of non-reinforced concrete cross-section of the depth „ $2h$ ” in comparison with the cross-section of the depth „ $h$ ” is:

- [ A ] 2x higher
- [ B ] 4x higher
- [ C ] 8x higher
- [ D ] 16x higher



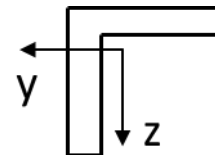
10) Axial force is zero in the members:

- [ A ] 1,2,9,10
- [ B ] 1,2,3,9,10
- [ C ] 3,6,9,10
- [ D ] None of the above statements is valid



11) The core of the cross-section has shape:

- [ A ] Square
- [ B ] Tetragon



Name and surname of the applicant (in block letters) : .....

Numeric application code: .....

[ C ] Pentagon

[ D ] Hexagon

12) The planar structure is statically indeterminate:

[ A ] 3x

[ B ] 2x

[ C ] 5x

[ D ] 4x



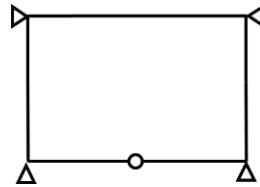
13) The planar frame is solved by the slope deflection method. How many unknown displacements, linear and angular, we must introduce? The structure has N degrees of freedom:

[ A ] 4x

[ B ] 6x

[ C ] 5x

[ D ] 7x



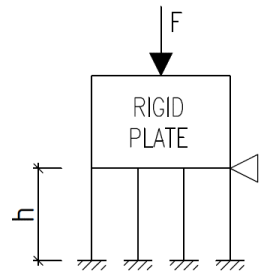
14) The theoretical effective length of columns supporting a rigid plate in the plane is:

[ A ]  $L = 2 \cdot h$

[ B ]  $L = 0.5 \cdot h$

[ C ]  $L = h$

[ D ]  $L = 0.7 \cdot h$



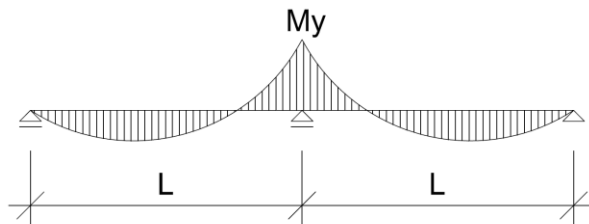
15) The value of the hogging bending moment  $M_y$  over the middle support of steel beam class 3 with uniform continual load  $g_d$  is:

[ A ]  $(1/12) \cdot g_d \cdot L^2$

[ B ]  $(1/8) \cdot g_d \cdot L^2$

[ C ]  $(1/8) \cdot g_d \cdot L$

[ D ]  $(1/4) \cdot g_d \cdot L^2$



Name and surname of the applicant (in block letters) : .....

Numeric application code: .....

16) Critical force of ideal member is possible express by following formula:

[ A ]  $N_{cr} = \frac{\pi \cdot E \cdot I^2}{L}$

[ B ]  $N_{cr} = \frac{\pi^2 \cdot L \cdot I}{E}$

[ C ]  $N_{cr} = \frac{\pi^2 \cdot E \cdot I}{L^2}$

[ D ]  $N_{cr} = \frac{\pi^2 \cdot E \cdot L^2}{I}$

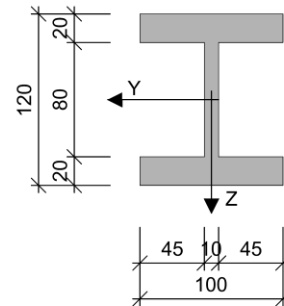
17) Elastic section modulus ( $W_{el,y}$ ) of „I“ profile shown in the picture is:

[ A ] 216 000 mm<sup>3</sup>

[ B ] 176 000 mm<sup>3</sup>

[ C ] 216 000 mm<sup>4</sup>

[ D ] 106 000 mm<sup>3</sup>



18) In fire design of timber structure using reduced cross-section method is strength and rigidity drop compensated by:

[ A ] Increasing of the charring depth

[ B ] Increasing of the characteristic strength of timber

[ C ] Increasing of the time when the fire affecting the structure

[ D ] All factors mentioned above

19) To perform its essential function, the reinforcement plaster mesh should be positioned:

[ A ] In the bottom third of plaster thickness (in the third furthest from the surface)

[ B ] In the top third of plaster thickness (in the third closest to the surface)

[ C ] At the interface between masonry and plaster

[ D ] None of the above, the mesh acts in the same way regardless its position in the plaster layer

20) A building component has thermal transmittance  $U = 0,5 \text{ W}/(\text{m}^2 \cdot \text{K})$ . The area of the building component is  $A = 10 \text{ m}^2$  and the temperature difference across the building component is  $20 \text{ }^\circ\text{C}$ . The heat loss through this building component is:

Name and surname of the applicant (in block letters) : .....

Numeric application code: .....

---

- [ A ] 200 W
- [ B ] 100W
- [ C ] 100 W/K
- [ D ] 200 W/s

21) The action of the resulting lateral pressure on an existing retaining wall:

- [ A ] Is higher if the underground water is below the foundation level of the wall
- [ B ] Is not changed by elevation of the water level above the foundation level
- [ C ] Is lower if the underground water is below the foundation level due to uplift
- [ D ] Is lower if the underground water is below the foundation level

22) Relationship between active earth pressure and angle of internal friction of soil:

- [ A ] Active pressure is higher if the angle of internal friction increases
- [ B ] Active earth pressure decreases if the angle of internal friction increases
- [ C ] Active earth pressure is not related to the angle of internal friction
- [ D ] Active earth pressure is related to the hydrostatic pressure only

23) Resistance of a vertically loaded pile which is embedded in dense sand is composed of:

- [ A ] The shaft resistance (skin friction) but the toe (tip) resistance is negligible
- [ B ] The shaft and the tip resistance
- [ C ] The tip resistance but the shaft resistance is negligible
- [ D ] The resistance of both (shaft and tip) but the total pile resistance is negligible because of the sand which is non-cohesive soil

24) Heat recovery in the ventilation equipment is used usually for:

- [ A ] Heating of the supply air with heat from the exhaust air.
- [ B ] Direct heating of hot water with waste heat from the fan drive.
- [ C ] Adjustment of absolute supply air humidity.
- [ D ] Drive fan motor.

25) Condensing boiler:

- [ A ] Utilizes changes in the state of water in the flue gas to increase efficiency.
- [ B ] Produces steam from the condensate in the steam heating system.
- [ C ] Is used to increase the return water temperature in the hot water system.
- [ D ] Is in the district heating station.