

## MECHANICS

1. Define the moment of a force about a point.
2. Reduction of a system of forces to a given point is:
3. The minimum number of simple links (pendulums) needed for the fixation of a solid body in the plan is:
4. The definition of the impulse:
5. Define the total work of a force applied to a rigid solid body performing a translational motion.
6. Enounce the D'Alembert's principle.
7. Enounce the principle of virtual work.
8. Enounce the second principle of dynamics.
9. Define the instant velocity:

## “Strength of Materials” Subjects for the Bachelor Diploma Project 2012

01) The principle of superposition of effects applies when are simultaneously valid the following fundamental hypothesis of Strength of Materials:

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02) The capable load (capable force;  $P_{cap}$ ) for the beam represented in Fig. 1 is:

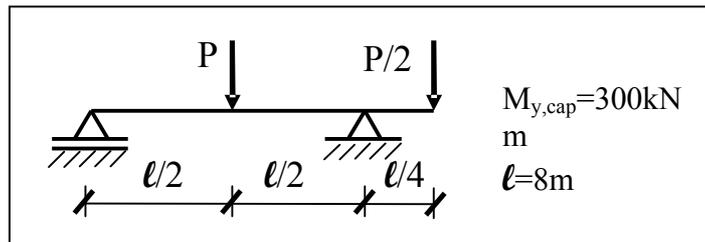


Fig. 1

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03) The maximum value of the shear stress  $t_{\text{max}}$  for the section represented in Fig. 2 is:

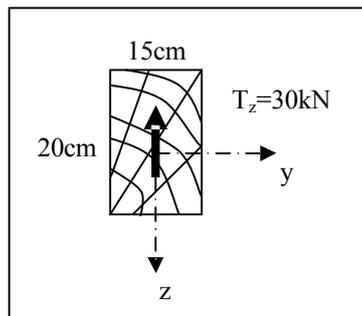


Fig.2

04) The verification of the beam represented in Fig. 3 must be performed in ...

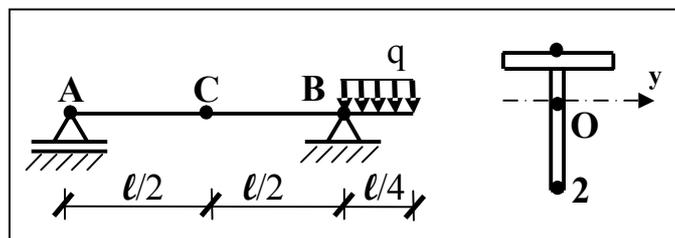


Fig. 3

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05) The displacements of the free end “A” of the cantilever represented in Fig. 4 are the following:

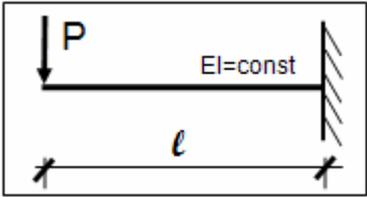


Fig. 4

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06) The ratio between the axial moments of inertia for the cross sections represented in Fig. 5 is:

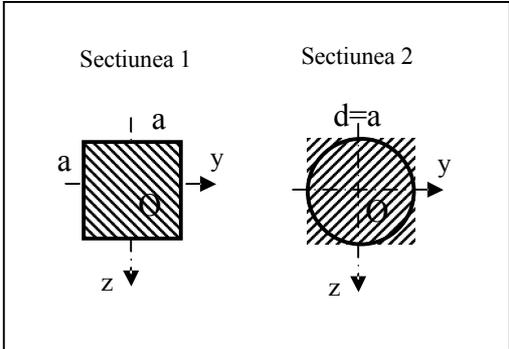


Fig. 5

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07) The magnitude of the normal stress at point “O” of the cross section represented in Fig. 6 is:

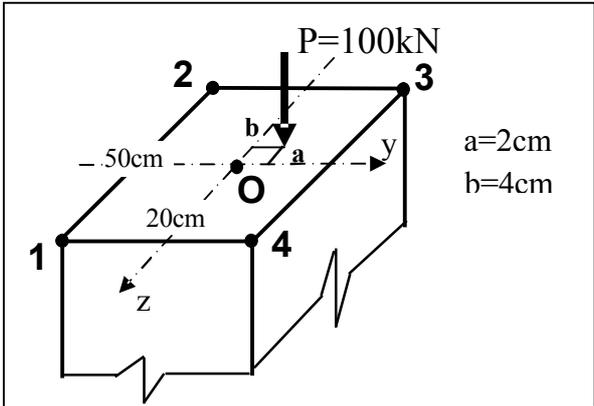


Fig. 6

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08) The corresponding buckling lengths for the bars represented in Fig. 7 are:

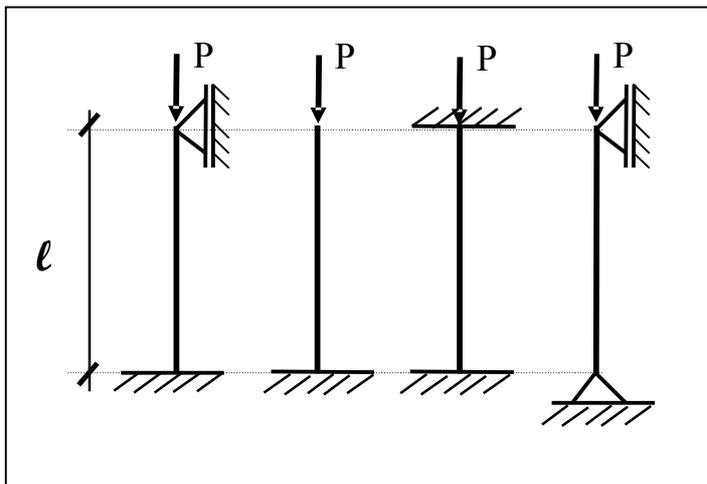


Fig. 7

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09) The plastic bending moment (limit bending moment) for the cross-section represented in Fig. 8 is:

Are given:

$$R = 210 \text{ N/mm}^2 ; S_c = 250 \text{ N/mm}^2$$

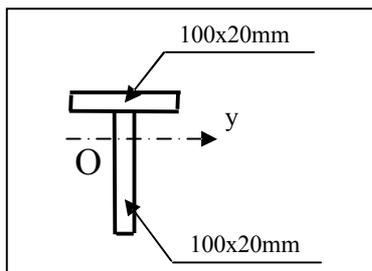


Fig. 8

### Bibliography

- [1] E. Pantel, A. Ioani, A.G. Popa, M. Nedelcu - Strength of Materials II. Theory and Problems, Ed. Napoca Star, Cluj-Napoca 2009;
- [2] C. Bia, V. Ille, M.V. Soare – Rezistenta materialelor si Teoria elasticitatii, EDP, Bucuresti, 1988;
- [3] A. G. Popa – Rezistenta materialelor, UTPress, Cluj-Napoca, 2010;
- [4] H.L. Cucu, A.G. Popa – Sinteze teoretice si aplicatii de Rezistenta materialelor, Ed. Mediamira, Cluj-Napoca, 2006.

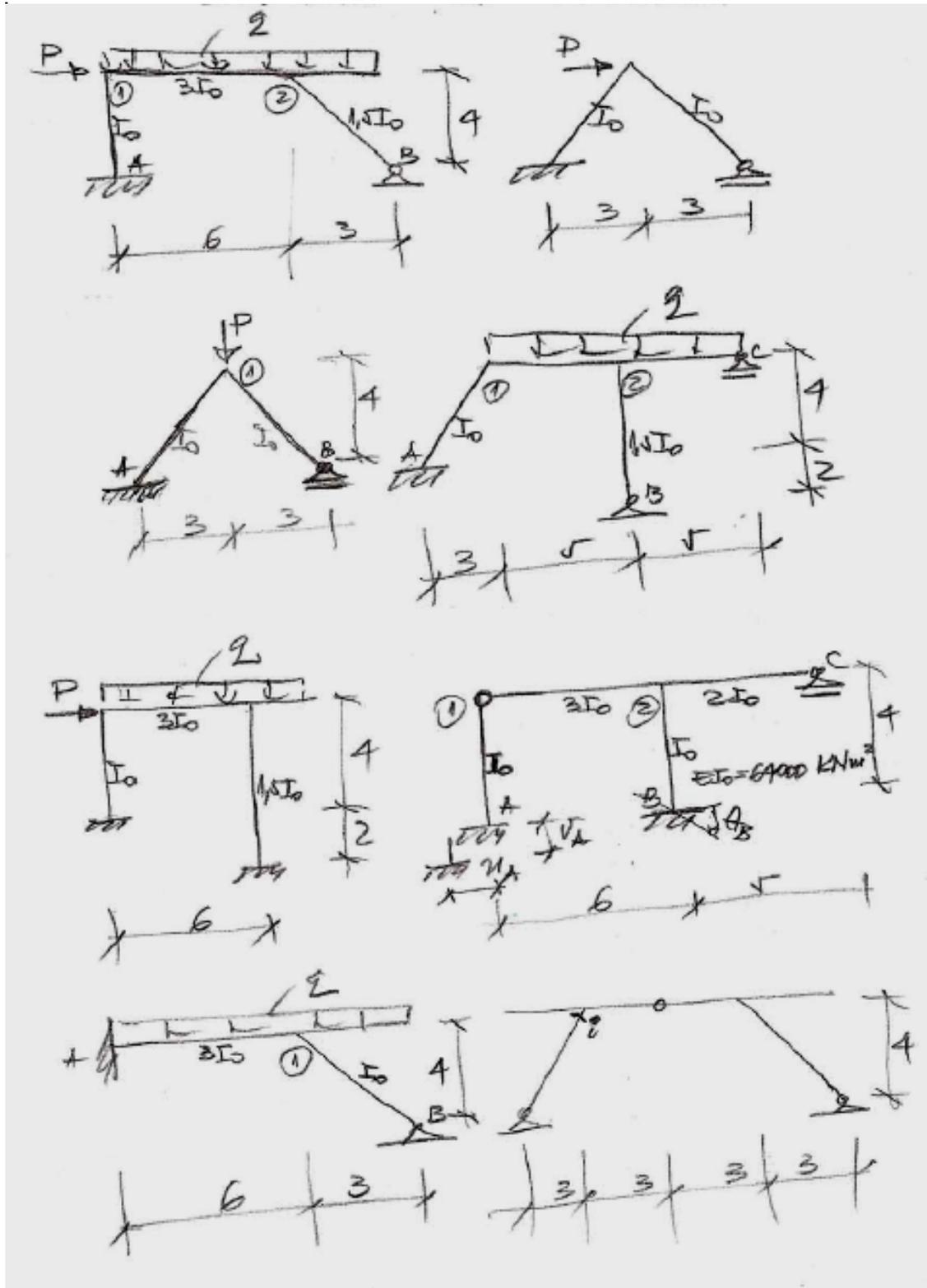
## STATICS

1. Bar stiffness at joint rotation.
2. Bar stiffness at bar rotation.
3. Bar rigidity at axial deformation.
4. For the structure in the figure below, which influence line is correct?
5. Displacement method. For the structure in the figure below, which one of the deformed shapes under  $Z_i = 1$  is correct?
6. Displacement method. For the structure in the figure below, which one of the bending moment diagrams produced by elastic displacements  $\theta_i = 1$  (or  $\psi_i = 1$ ) is correct?
7. Displacement method. For the below structure subjected to temperature change ( $\Delta t$  or  $t$ ) which one of the bending moment diagrams on the primary structure (structure with clamped joints) is correct?
8. For the below structure with its final bending moment diagram, which one of the values  $T_1$  (on the beam) is correct?
9. For the below structure with its final bending moment diagram, which one of the values  $M_{\max}$  is correct?

## COMPUTER PROGRAMMING

1. Where does the abbreviation FORTRAN come from?

## EXAMPLE OF STRUCTURES



### **BSc Exam Questions (Dynamics)**

1. The differential equation of forced damped vibrations of single-degree-of-freedom systems is:
2. The eigen dynamic characteristics (eigen frequencies, eigen vectors, etc) of multi-degree-of-freedom systems are represented by:
3. The orthogonality property of eigenvectors of multi-degree-of-freedom systems is given by:
4. The matricial differential equation of forced damped vibrations of a multi-degree-of-freedom system is given by:
5. The modal analysis method used for evaluation of dynamic response of multi-degree-of-freedom systems assumes the following:

#### References

1. Barsan G.M., Dinamica si Stabilitatea Constructiilor, Ed. Didactica si Pedagogica, Bucuresti, 1978
2. Bors, I., Dinamica Constructiilor-Breviar Teoretic si Aplicatii, Ed. UT Press, 2010.
3. Chopra A.K., Dynamics of Structures-Theory and Applications to Eartquake Engineering (Third Edition), Prentice Hall, 2007.

## Questions for Earthquake Engineering subject at Bsc degree examination

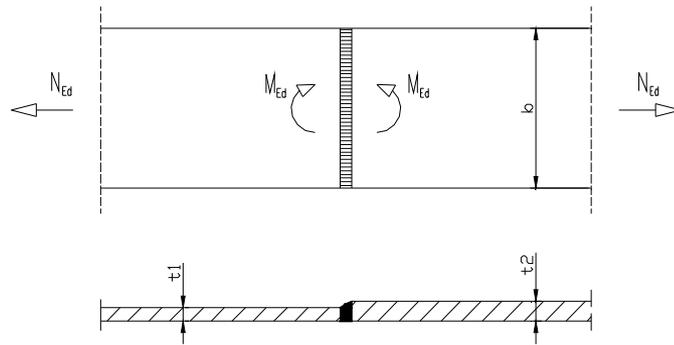
1. What are the factors which is dependent the behavior factor “q” ?
2. Define each factor from shear force  $F_b$  , formula corresponding to the fundamental vibration mode, accordingly with the P100 Design Cod.
3. What are the recommended forms in plan for buildings located in the seismic area?
4. What are the factors which influence the ductility of reinforced concrete elements?
5. When the base seismic isolation is the most effective?

### REFERENCES

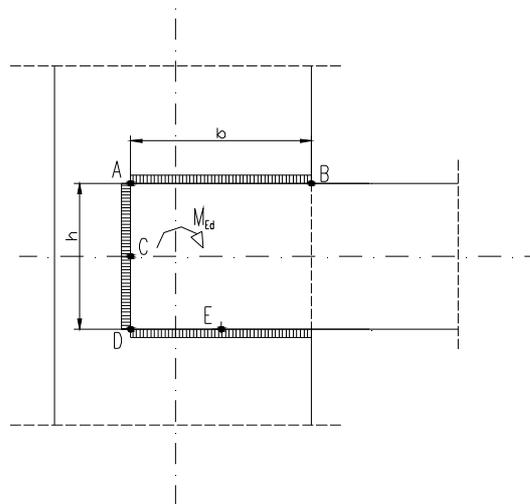
1. Al. NEGOITA & Colectiv – Inginerie Seismica, Editura Didactica si Pedagogica, Bucuresti, 1985
2. Al. NEGOITA & Colectiv – Aplicatii ale ingineriei seismice , Vol I.si II, Editura Didactica si Pedagogica, Bucuresti, 1989
3. J. KELLY - Resistant Earthquake Design with Rubber, second edition, Springer 1997
4. Doina VERDES, Basics of Seismic Engineering, UT PRESS 2011
5. \*\*\*Normativul P100-2006

## Composite Steel-Concrete and Metallic Structures.

- For butt welding joints subjected to bending moments from figure, the unit stress in the weld is calculated with:

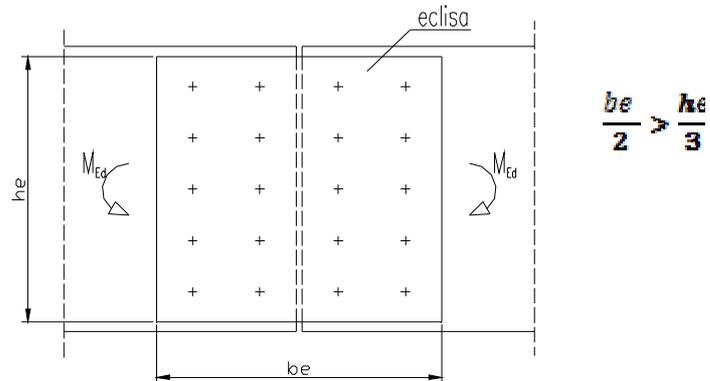


- For front and lateral seam welds, subjected to bending moments, from figure, which point of joint are the maximum stresses in the bending moment verified:



- The bolts in a joint subjected to axial forces in the plane of the joint can take over:
- The effective stress of an ordinary bolt in a joint subjected to a force acting in the plane of the joint, is:

5. For ordinary screwed joints, subjected to bending in the joint plane, from figure, the stress analysis is effected as:



6. The bearing capacity of a high strength, prestressed screwed joint is calculated analyzed with:
7. How should the corrngated sheet be placed on a composite steel-concrete slab mesh?
8. How is the bearing capacity of a stud typer connector, analyzed?
9. For calculating the M-N interaction curve for a composite steel-concrete column, one encounters:
10. The normal values of the  $f_y$  yield point, and  $f_u$  tensile strength for hot laminated steel may have different values for the same steel brand?
11. Which is the scope the lateral steel sections are classified in accordance with EN 1993-1-1?
12. The coefficient of stability loss  $\chi$  in the relation for analyzing a structural element subjected to axial centric compression  $\frac{N_{Ed}}{\chi N_{Rd}} < 1$  is NOT affected by:

13. Procedures recommended to prevent stability losses in fixing girders, due to lateral buckling(run-off):
14. In conformity with EN 1998-1 (chapter 6-Specific rules in steel buildings), for the calculation of columns increased stresses from seismic loads are used:

$$N_{Ed} = N_{Ed,G} + 1,1\gamma_{ov}\Omega N_{Ed,E}$$

$$M_{Ed} = M_{Ed,G} + 1,1\gamma_{ov}\Omega M_{Ed,E}$$

$$V_{Ed} = V_{Ed,G} + 1,1\gamma_{ov}\Omega V_{Ed,E}$$

Where

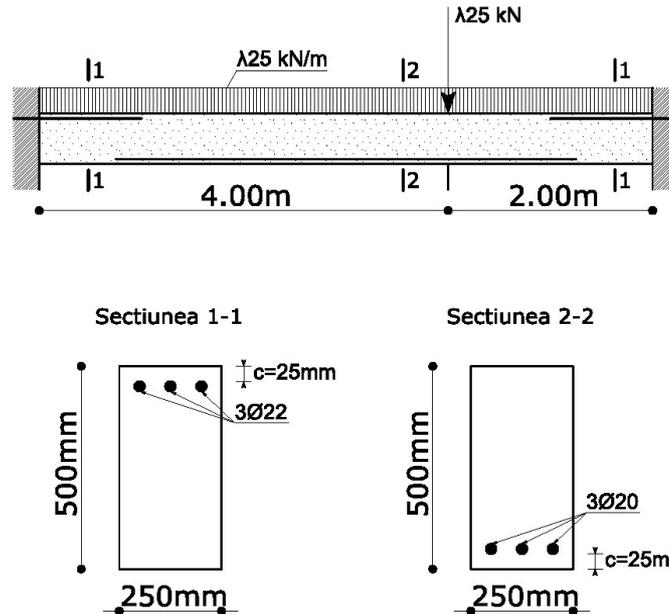
$N_{Ed,G}$  ( $M_{Ed,G}$ ,  $V_{Ed,G}$ ) is the compressive force,( respectively the bending moment and shearing force) in the column, due to seismic actions included in the combined actions from seismic loadings;

$N_{Ed,E}$  ( $M_{Ed,E}$ ,  $V_{Ed,E}$  ) is the compressive force (the bending moment and shearing forces, respectively) in the column due to designed seismic loadings;

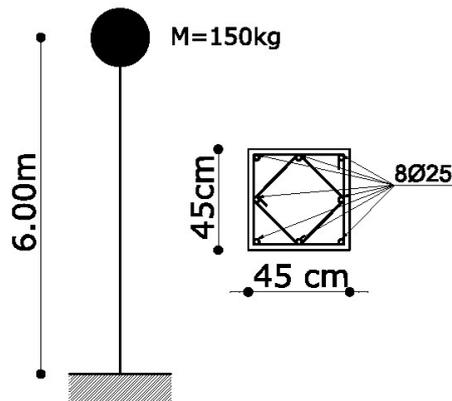
At what higher limit value does the product  $1,1\gamma_{ov}\Omega$  stand?

## REINFORCED CONCRETE STRUCTURES

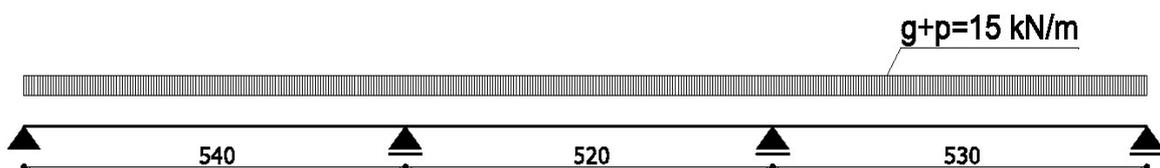
1. Determine the loading factor of the beam shown in the figure below using the kinematic method. The characteristic yielding strength of steel is  $f_{yk}=350$  MPa.



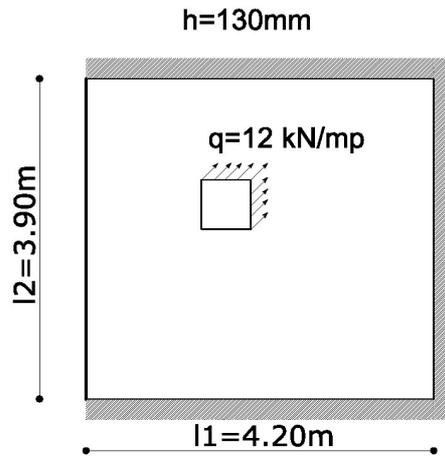
2. Determine the fundamental period of vibration for the reinforced concrete column given in the figure below. The unit mass of the reinforced concrete is  $2500$  kg/m<sup>3</sup> and the Young modulus is  $E_s=200\ 000$  MPa for steel and  $E_c=20\ 000$  MPa for concrete.



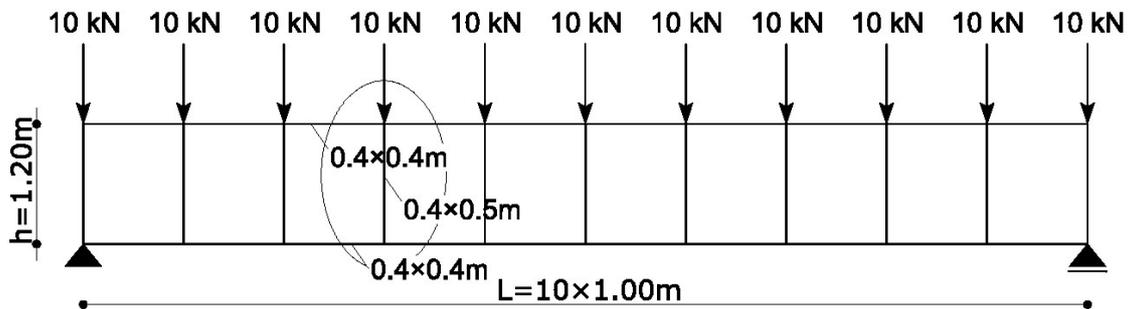
3. Determine the bending moments of the unidirectional reinforced concrete slab in the drawing below using the Simplified Plastic Domain Design.



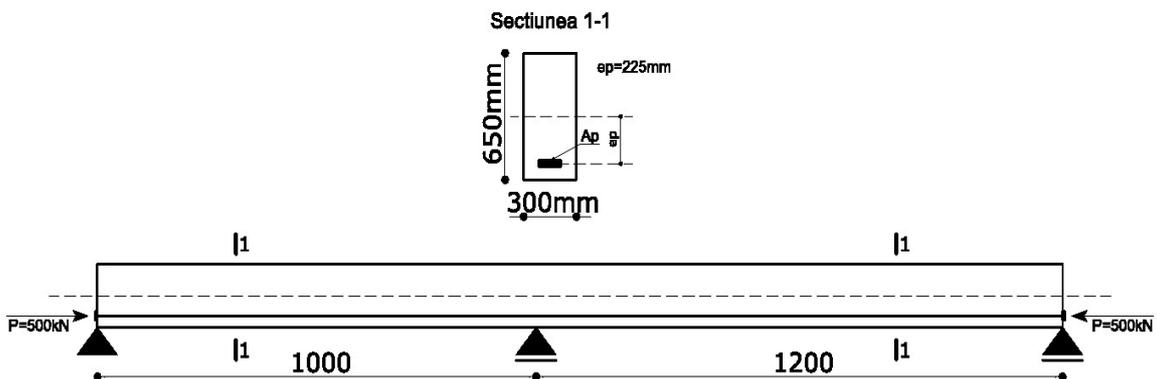
4. Determine the necessary reinforcement ( $f_{yd}=300$  MPa,  $f_{cd}=12$  MPa) in the slab panel shown below, using the limit equilibrium method in the plastic domain.



5. Determine the efforts (M, V, N) in the emphasized elements of the frame (Vierendeel) beam shown below:

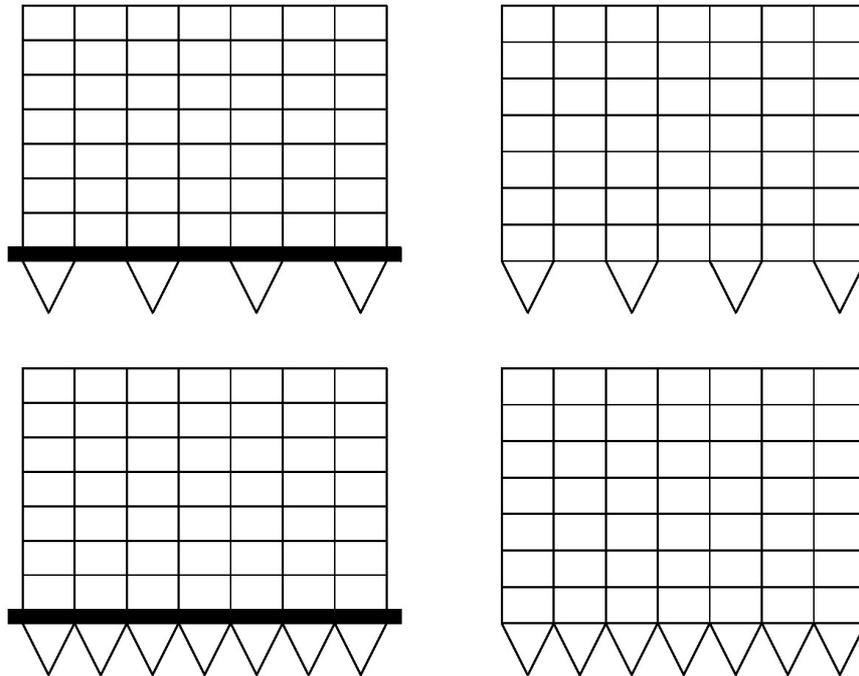


6. Draw the bending moment diagram (with values) of the prestressing force for the PC beam given below:



7. Define the tendons layout limits zone for a Prestressed Concrete simply supported beam?

8. Which of the following structural solutions are wrong?



9. Provide reinforcing solutions for the angled frame nodes of Reinforced Concrete Structures.

10. Explain the simplified structural analysis of multistorey frame structures against lateral loads.

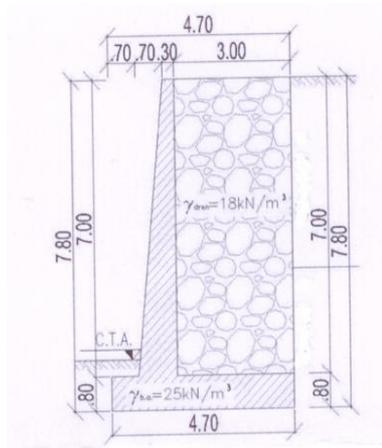
**License exam subjects 2011**  
**GEOTECHNICS & FOUNDATIONS**

1. Calculate the value of soil active force (thrust), acting on a vertical surface, having  $h=3.00\text{m}$  height, using Rankine theory. Retained soil is silty sand, brownish, having the following design characteristics:  $\gamma=19\text{kN/m}^3$ ,  $\phi_d=15^\circ$ ,  $c_d=3\text{kPa}$ . On the soil surface acts a surcharge  $q_d=10\text{kN/m}^2$ .

2. Verify sliding resistance for the retaining wall from the below figure, calculating soil pressure in Rankine theory, considering the following soil stratigraphy:

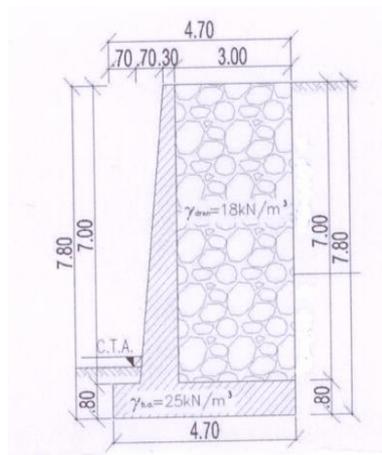
$\pm 0.00 \dots -12.00$ : Clayey sand, brownish, plastic consistency, with design geotechnical characteristics:  $\gamma=20\text{kN/m}^3$ ;  $I_p=10\%$ ;  $I_c=0.74$ ;  $\phi'_d=18^\circ$ ,  $c'_d=5\text{kPa}$ ,  $e=0.69$ .

Friction coefficient is:  $m = \tan \frac{2}{3} j'_d$ . Passive pressure in front of the wall is neglected.



3. Determine destabilizing moment for the retaining wall from below figure, calculating earth pressure in Rankine theory and considering the following soil stratigraphy:

$\pm 0.00 \dots -12.00$ : Clayey sand, brownish, plastic consistency, with design geotechnical characteristics:  $\gamma=20\text{kN/m}^3$ ;  $I_p=10\%$ ;  $I_c=0.74$ ;  $\phi'_d=18^\circ$ ,  $c'_d=5\text{kPa}$ ,  $e=0.69$ .



4. Specify the most appropriate foundation type to realize the foundation system for a frame structure, loaded by important loads. Soil stratigraphy is:

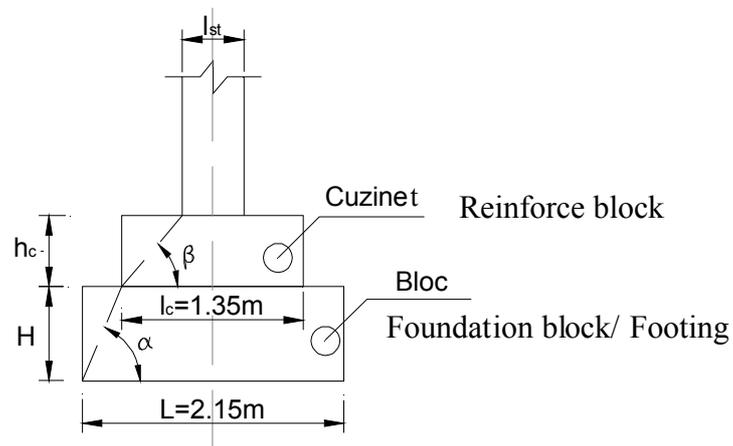
1. 0.00m – -6.00m - Muddy silty clay, brownish, soft, compressible, with geotechnical characteristics:  $I_c=0.20$ ,  $\varphi_{uk}=0^\circ$ ,  $c_{uk}=15\text{kPa}$ ,  $E=3500\text{kPa}$ .

2. -6.00m - -18.00m – Marly clay, greyish, hard, with geotechnical characteristics:  $I_c=1.20$ ,  $\varphi_{uk}=0^\circ$ ,  $c_{uk}=150\text{kPa}$ ,  $E=50000\text{kPa}$ .

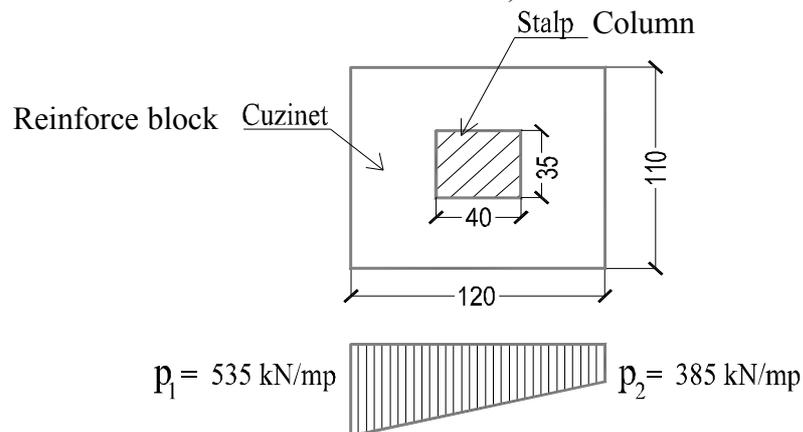
Ground water table is at -0,50m depth from the natural ground level.

5. Specify the correct joining solution for a continuous foundation encountered at different foundation levels. Foundation level 1=-1.10m, Foundation level 2=-3.60m. Foundation soil is brownish hard clay.

6. Determine the minimum height of the concrete block, for the stiff foundation from the below figure. It is known  $\text{tg}\alpha_{adm}=1.35$ .

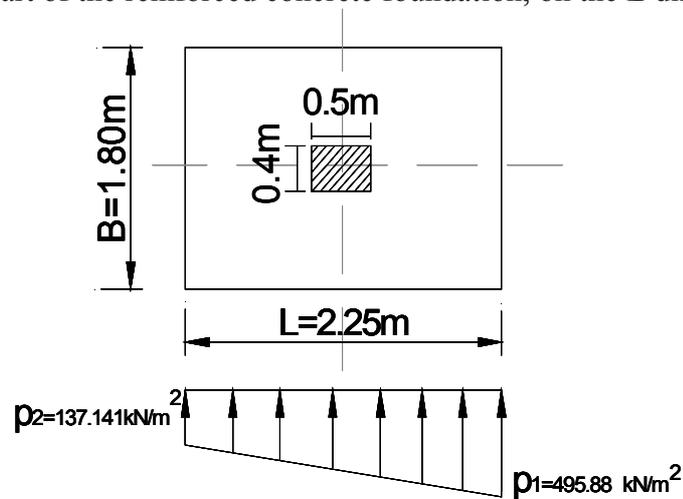


7. The bending moment at the column side, used to determine the reinforcement area on the inferior part of the reinforced concrete block of a stiff foundation (on the longest direction of the reinforced concrete block) is:



Note: pressures are given without reinforced concrete block self weight.

8. The bending moment at the column side, used to determine the reinforcement area on the inferior part of the reinforced concrete foundation, on the L direction, is:



References :

1. SR EN 1997-1/2006. Proiectarea geotehnică.
2. EUROCODE 7. Geotechnical design. General rules
3. ROBERT W. DAY - Foundation engineering handbook, 2006 by The McGraw-Hill Companies, Inc.
4. V.POP – Geotehnică și fundații, Lito IPCN, 1983
5. A. POPA, F. ROMAN – Calculul structurilor de rezistență pe mediu elastic, 2000
6. V.POP, col. – Proiectarea fundațiilor, Lito IPCN, 1985.
7. A. Stanciu, I. Lungu – Fundații – Fizica și mecanica pământurilor, Ed. Tehnică, 2006
8. Păunescu Marin, Pop Viorel, Tudor Sillion – Geotehnică și Fundații, EDP București 1982
9. Iacint Manoliu – Fundații și Procedee de Fundare, EDP București 1983
10. Popa A., Fărcaș V., - Geotehnică, U.T.Pres, 2004
11. \* \* \* STAS and romanian norms

## MATERIALS OF CONSTRUCTION

### Mineral binders

1. Mineral binders are defined as:
2. Setting time is defined as:

### Cement

3. The Portland cement is used for:

### Mortar

4. Choose the correct definition for mortar:
5. Plastering for masonry consist of:

### Concrete

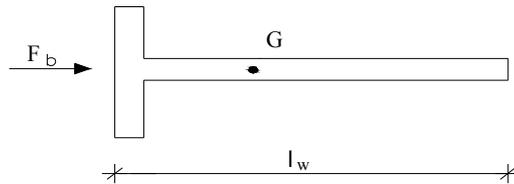
6. High strength concrete is obtained using:
7. The standard compressive strength at 28 days determined on cylinders with a 150 mm diameter and 300 mm height or cubes with a 150 mm side, expressed in  $\text{N/mm}^2$  is:
8. In order to prevent massive water loss in the first (7 – 14) days concrete will be:

### References

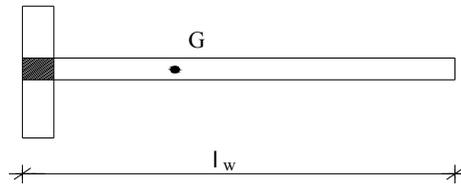
1. Aciu Claudiu, Manea Daniela, Netea Alexandru – Building materials and applied chemistry – Laboratory Works, Ed. UT PRESS, Cluj-Napoca, 2010
2. Florica Paul – Civil engineering materials – Ed. MATRIX ROM, Bucuresti, 2008
3. Netea Alex., Manea Daniela – Materiale de construcție si chimie aplicata – Vol I, Ed. MEDIAMIRA, 2007
4. Manea Daniela; Aciu Claudiu, Netea Alexandru – Materiale de construcții – Vol II, Ed. UTPRESS, 2011
5. Netea Alex., Manea Daniela, Aciu Claudiu – Materiale de construcție si chimie aplicata – Vol III, Ed. UTPRESS, 2011
6. Netea Alex., Manea Daniela – Materiale de construcție si chimie aplicata – Vol V, Ed. MEDIAMIRA, 2007

## BUILDINGS

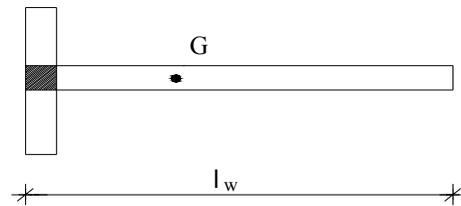
1. In which of the following situations the condensation phenomenon appears in the internal structure of the elements employed for closing?
2. What is the efficient position of the tie-column for the pier shown in Figure, when the horizontal load act from left to right?



3. For the piers shown in Figure, one determines  $M_{Rd}$  and the related  $N_{Ed}$ . When  $M_{Rd}$  will have a maximum value:



4. In what case the shear strength ( $V_{Rd}$ ) will be maximum for the piers shown in Figure:



5. The preliminary checking of diaphragms is related to:
6. Where are placed the reinforcements determined for the eccentric compression (for the related  $M_{Rd}$  and  $N_{Ed}$ ) ?
7. How are the reinforcements laid to take over the shear stresses in the piers?
8. The reinforcing of the connecting beams against shear is made taking into account that the shear force is taken over by:

**9. Coefficient of height  $k_h$  for solid timber is given by the following relations:**

$$k_h = \min \left\{ \left( \frac{150}{h} \right)^{0.2} \right. \\ \left. 1, 3 \right.$$

where 'h' is defined as:

**10. The level of fire resistance for buildings, according to P118-99 norm, is determined following :**

**11. The resistance of timber structural elements at the action of fire is determined by:**

**12. The procedure employed in the calculation of the structures exposed to fire, according to SR EN 1991-1-2:2004, implies:**

#### BIBLIOGRAFIE

\*\*\* Note de curs

ANDREICA Horia-A. s.a., CONSTRUCTII CIVILE I , U.T.PRESS, 2009, ISBN 978-973-662-501-5

DUMITRAS Macedon, s. a. CONSTRUCTII CIVILE II , U.T.PRESS, 2011, ISBN 978-973-662-627-2

MARUSCIAC Dumitru, s.a. PROIECTAREA STRUCTURILOR ETAJATE PENTRU CONSTRUCȚII CIVILE, - Editura Tehnica, Bucuresti 2000, 510 pag., ISBN 973-31-1504-5

ANDREICA Horia-A. s.a., STRUCTURI DIN LEMN , U.T.PRESS, 2007, ISBN 978-973-662-341-7

\*\*\* Normativul P118 -99

## **SUBJECTS MANAGEMENT**

1. The informational roles of a manager are:
2. The urbanism certificate has data regarding:
3. The indirect expenses represent:
4. The types of the traditional contracts are:
5. The material stock for the site organization is estimated by the formula:

### **BIBLIOGRAFIE**

1. HOSSU, T., s.a., “*Managementul firmelor de construcții*”, Editura Casa Cărții de Știință, 2001
2. CHIOREANU, T., “*Prețul lucrărilor de construcții*”, Editura UT Pres, 2004
3. ANASTASIU, L., *Note de curs*

## TECHNOLOGY

1. The minimum number of reinforcing bar supports in a reinforced concrete slab not be less than:
2. The removal of beam and slab props have to take place when compression strength of concrete class not be less than:
3. The duration of vibration of concrete mixes for immersion vibrators is
4. Concrete mix is laid in layers which not exceed from the length of vibrator:
5. The free falling of concrete mixes in column and wall formworks not exceed:

## BIBLIOGRAFIE

1. J. Domsa, V. Vescan, A. Moga – Tehnologia lucrarilor de constructii, IPC 1988.
2. R. Pasca, A. Moga – Tehnologia lucrarilor de terasamente, UTPRESS 2003.
3. Notite de curs – Prof.dr.ing. Moga Andrei.