# SYLLABUS

## 1. Data about the program of study

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|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Faculty of Civil Engineering |
| 1.3 | Department | Structural Mechanics |
| 1.4 | Field of study | Civil Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | CCIA English/Engineer |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | 33.00 |

## 2. Data about the subject

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| 2.1 | Subject name | | | Statics II | | | |
| 2.2 | Subject area | | | | | | |
| 2.3 | Course responsible/lecturer | | | Prof. dr .ing. Mircea Petrina/Asist. ing.Moldovan Ilinca | | | |
| 2.4 | Teachers in charge of seminars | | | Asist. ing.Moldovan Ilinca | | | |
| 2.5 Year of study | III | 2.6 Semester | 1 | 2.7 Assessment | Exam | 2.8 Subject category | DID |

## 3. Estimated total time

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|---|---|---|---|---|---|
| 3.1 Number of hours per week | 5 | 3.2 of which, course: | 3 | 3.3 applications: | 2 |
| 3.4 Total hours in the curriculum | 70 | 3.5 of which, course: | 42 | 3.6 applications: | 28 |
| Individual study | | | | | hours |
| Manual, lecture material and notes, bibliography | | | | | 40 |
| Supplementary study in the library, online and in the field | | | | | 12 |
| Preparation for seminars/laboratory works, homework, reports, portfolios, essays | | | | | 28 |
| Tutoring | | | | | 6 |
| Exams and tests | | | | | - |
| Other activities | | | | | - |

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| 3.7 | Total hours of individual study | 86 |
| 3.8 | Total hours per semester | 156 |
| 3.9 | Number of credit points | 6 |

## 4. Pre-requisites (where appropriate)

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| 4.1 | Curriculum | Courses of Mechanics I, Strength of Materials I,Statics I |
| 4.2 | Competence | |

## 5. Requirements (where appropriate)

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| 5.1 | For the course | Amphitheater with blackboard |
| 5.2 | For the applications | Classroom with blackboard, calculators |

**6. Specific competences**

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| Professional competences | Theoretical knowledge:<br>-applying building and design codes;<br>-idealizing structures- simplified physical model of the structure and its supports as well as the applied loads;<br>-establish the determinacy, indeterminacy, and stability of structures;<br>-equations of static equilibrium and construction conditions;<br>-writing expressions for internal forces at any section in terms of external loads;<br>-constructing the internal forces curves;<br>-sketching the deflected shapes of loaded beams and frames;<br>-how to position live loads to maximize the value of a certain type of force at a designated section of a structure. |
| Cross competences | The structural engineer interacts continuously with other engineers and architects. The structural engineer is responsible for the creation of a structural system in harmony with each of the architectural alternatives, sizing the elements in the structure to determine the feasibility and to estimate the construction cost. A large number of structural engineers are engaged in the research field. |

**7. Discipline objectives (as results from the *key competences gained*)**

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| 7.1 | General objective | Fundamental concepts must be mastered by any student to applying them to the solution of problems through using classical method, which focus on specific modes of structural response and behavior, before proceeding with the more general matrix methods. Structural analysis teaches the student to determine the response of a structure to specified loads and actions, response measured by establishing the forces and deformations throughout the structure. |
| 7.2 | Specific objectives | The engineer will be required to make many technical decisions about structural system: selecting an efficient, economical and attractive structural form, evaluating its safety (stiffness and strength), and planning its erections under temporary construction loads. |

**8. Contents**

| 8.1. Lecture (syllabus) | | Teaching methods | Notes |
|---|---|---|---|
| 1. | Analysis of indeterminate structures by the flexibility method:concept of a redundant,fundamentals of flexibility method. | Lecture with discussions | |
| 2. | Analysis of indeterminate structures by the flexibility method:support settlements,temperature change and fabrication errors. | | |
| 3. | Analysis of indeterminate structures by the flexibility method: analysis of structures with several degrees of indeterminacy,beam on elastic supports,practical design. | | |
| 4. | Analysis of indeterminate structures by the flexibility method:continuous beams with three-moment equation. | | |
| 5. | Space structures:pin-jointed space frames (space truss | | |

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| | structures),stability and determinancy,joint equilibrium equations (matrix method),plane structures loaded normal to their plane. | | |
| 6. | Analysis of indeterminate beams and frames by the slope-deflection equations:kinematic indeterminacy,derivation of the slope-deflection equations,use of symmetry. | | |
| 7. | Analysis of structures without sidesway and analysis of structures that are free to sidesway. | | |
| 8. | Moment Distribution:Hardy Cross procedure,development of the M.D. method,frames with no joint translation. | | |
| 9. | Moment Distribution: frames with side sway, support settlements, fabrication errors and temperature change(linear and nonlinear). | | |
| 10. | Influence lines for indeterminate structures:construction of influence lines using moment distribution,Muller-Breslau principle,qualitative influence lines for beams and frames,influence lines for continuous beams,live load patterns to maximize forces in multistory buildings. | | |
| 11. | Approximate analysis of indeterminate structures:guessing the location of inflection point,estimating deflections of trusses. | | |
| 12. | Approximate analysis of indeterminate structures:approximate analysis of a multistory rigid frame for given loads,analysis of unbraced frames for lateral loads by portal and cantilever method. | | |
| 13. | Plastic analysis:moment-rotation characteristics of general cross section,plastic hinge,plastic moment,effect of axial force on the plastic moment capacity. | | |
| 14. | Matrix structural analysis-truss structures | | |
| 8.2. Applications/Seminars | | Teaching methods | Notes |
| 1. | Flexibility method applied to a frame statically indeterminate of degree one:internal forces curves. | Problems solving with discussions | |
| 2. | Flexibility method applied to a frame statically indeterminate of degree two:internal forces curves. | | |
| 3. | Flexibility method applied to a frame statically indeterminate of degree one,loaded with support settlement,temperature change and fabrication error,internal forces curves. | | |
| 4. | Continuous beams solved with the three-moment equation. | | |
| 5. | Slope-deflection method:frames without sidesway(frame with one joint),internal forces curves. | | |
| 6. | Slope-deflection method:frames without sidesway(frame with two joints),internal forces curves. | | |
| 7. | Slope-deflection method:frames with sidesway. | | |
| 8. | Slope-deflection method:frames without sidesway solved with Cross method. | | |

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| 9. | Slope-deflection method:frames with sidesway solved with Cross method(one joint frame). | | |
| 10. | Slope-deflection method:frames with sidesway solved with Cross method(two joints frame). | | |
| 11. | Influence lines for indeterminate frames. | | |
| 12. | Influence lines for continuous beams. | | |
| 13. | Approximate analysis of indeterminate structures :analysis of unbraced frames for lateral loads by portal and cantilever method. | | |
| 14. | Plastic analysis:plastic hinge. | | |

Bibliography


1. White, R.N., Gergely, P., Sexsmith, R.G., Structural Engineering, volume 1 and 2, John Wily&Sons, NY., 1976.
2. West,H.H., Fundamental of Structural Analysis, John Wily&Sons, NY., 1993.
3. Kassimali, A., Structural analysis, PWS-KENT publishing Co., Boston, 1993.
4. Gali, A., Neville, A.M., Structural Analysis-a unified classical and Matrix Approch, E&FN Spon , London, 1997.
5. Catarig, Al, Petrina, M., Statica Constructiilor-Metode de calcul si aplicatii, Ed. Dacia, Cluj-Napoca, 1991.
6. Mazilu, P., Statica Constructiilor, vol. 1 and 2, Ed. Tehnica, Bucuresti, 1955, 1959.
7. Catarig, Al, s.a., Statica Constructiilor(Teorie si aplicatii)- Structuri static determinate, Vol.1. Editura U.T.Pres, Cluj-Napoca,2003.


**9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field**

Acquired skills will be needed for civil engineers who work in design and buildings firms, and are fundamental for those who will follow master and doctoral programmes in the field of Civil Engineering.

**10. Evaluation**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Weight in the final grade |
|---|---|---|---|
| Course | 2 theory subjects | Written examination | 40% |
| Applications | 4 problems | Written examination | 60% |
| 10.4 Minimum standard of performance | | | |
| The minimum average mark of the two theory subjects is 5 (five).<br>Attendance at laboratory works, solving and submitting homework is mandatory under the provisions of ECTS Regulation. | | | |

Date of filling in
February 22,2016

Teachers in charge of seminars
Asist.ing.Moldovan Ilinca

Date of approval in the department

Head of department
Prof. dr. ing. Cosmin Chiorean