# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mecatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS / DIPLOMA ENGINEER |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | Chemistry | | | Code | MCTEN.101.FO |
| 2.2. Course coordinator | Associate Professor PhD. Eng. Adrian TURTUREANU | | | | |
| 2.3. Seminar/laboratory coordinator | Associate Professor PhD. Eng. Adrian TURTUREANU | | | | |
| 2.4. Year of study[2] | 1 | 2.5. Semester[3] | 1 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | R | 2.8. The formative category of the course[6] | | | F |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 1 | - | 1 | - | - | **2** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 14 | - | 14 | - | - | **28** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 28 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | - |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*** | **47** |
| **3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*** | **28** |
| **3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | - |
| 4.2. Competencies | - |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Blackboard, videoprojector. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Reagents, glassware, laboratory equipment. In the laboratory the students will come with protective coat and the theme that will be discussed and performed in the lab will be prepared at home. |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 3 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Applying basic general and speciality technical knowledge for solving technical problems specific for the field of study Mechatronics and Robotics | 2,50 |
| | PC2 | Creating and using schemes, structural and functional diagrams as well as graphical representations and technical documents specific for the field of study Mechatronics and Robotics | |
| | PC3 | Design, manufacturing and maintenance of subsystems and components of mechatronic systems | |
| | PC4 | Realizing local automation applications in mechatronics and robotics using tyified and non-typified components and partial assemblies as well as CAD resources | |
| | PC5 | Design, manufacturing and maintenance of electronic control susbsystems of mechatronic systems | |
| | PC6 | Computer aided design, manufacturing and maintenance of mechatronic systems by integrating component subsystems (mechanical, electronic, optical, informational subsystem etc.) | |
| **6.2. Transversal competencies** | TC1 | Carrying out professional tasks with precisely identifying goals to be achieved, available resources, conditions for finishing them, work stages, work time and the corresponding deadlines. | 0,25 |
| | TC2 | Responsible execution of pluridisciplinary team work tasks, with the assumption of roles on various hierachical levels | |
| | TC3 | Identifying the need for continuous training and efficient usage of information sources and of computer-aided resources for communication and professional training (Internet portals, specialized software applications, databases) | 0,25 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The course, designed for students of first year, is part of the curriculum of basic training and aims to form a solid base of information necessary in preparing the specialized disciplines. Theme of laboratory work follows theme of the course in order to supplement and fixation the knowledge. Also is aimed to acquire practical skills and to increase the acuity of thinking. The focus is on interpreting and processing results. |
| 7.2. Specific course objectives | Students :<br>• will have general knowledge of chemistry that are necessary in profession;<br>• will know and properly use specific terms;<br>• will understand chemical properties and behavior of materials based on the structure and chemical composition;<br>• will know how to use specific laboratory equipment;<br>• will be familiar with working with various categories of chemicals. |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | Ionic bond. Covalent bond. Metallic bond. | PowerPoint presentation | 2 |
| Lecture 2 | Physical and mechanical properties of metals. Chemical properties of metals. | PowerPoint presentation | 2 |
| Lecture 3 | Electrical properties of the substances: conductors, semiconductors, insulators. Water and its applications in industry. Water hardness. | PowerPoint presentation | 2 |
| Lecture 4 | Red-ox reactions. Electrolytic dissociation, electrolytes. Electrolytic dissociation of water, pH. | PowerPoint presentation | 2 |
| Lecture 5 | Electrolysis, laws and applications. Electrochemical cells: primary, secondary and combustion cells. | PowerPoint presentation | 2 |
| Lecture 6 | Corrosion: corrosion types, corrosion evaluation, iron rust. | PowerPoint presentation | 2 |
| Lecture 7 | Protection methods for metals and alloys against corrosion. | PowerPoint presentation | 2 |
| | | **Total lecture hours:** | **14** |

**8.2 Practical activities**

| **8.2.a. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Training on labor protection. Specific operations and chemistry laboratory equipment. | Presentation | 2 |
| Laboratory 2 | Solutions concentration. Preparation of 0,1 N HCl solution and determination of its actual titre. | Seminar, lab activity | 2 |
| Laboratory 3 | Determination of water hardness. | Seminar, lab activity | 2 |
| Laboratory 4 | Determination of solutions pH. | Seminar, lab activity | 2 |
| Laboratory 5 | Metals and alloys protection against corrosion by electroplating. | Seminar, lab activity | 2 |
| Laboratory 6 | Determination of lubricating oils viscosity. | Seminar, lab activity | 2 |
| Laboratory 7 | Laboratory test. Checking work reports. | Written test | 2 |
| | | **Total laboratory hours:** | **14** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Turtureanu, A., *Chimie generală*, Ed. Univ. "Lucian Blaga" din Sibiu, 2016. |
| | Turtureanu, A., Lucrări practice de chimie, Ed. Univ. "Lucian Blaga" din Sibiu, 2018. |
| | |
| | |
| 9.2. Additional Bibliography | Any book (didactic material) existing in the library, book shop or on the net, that has as interest the material taught at the course. |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]

It is carried out through regular discussions in a formal and informal setting with the representatives of the profile companies.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[25]: | 50 %<br>1 test in week 7 or 8 | 66,67 % | CEF |
| | | Final evaluation: | 50 % | | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc. | | 33,33 % | CEF |
| 11.5 Minimum performance standard[26]<br>• 50% from results after summing the weighted scores, according to item 10.3.<br>• To promote, the student must achieve at written tests at least note 5 and at least note 5 at the laboratory activities. | | | | | |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. Prof. PhD. Eng. Adrian TURTUREANU | |
| **Study Program Coordinator** | Lecturer PhD. Eng. Mihai CRENGĂNIȘ | |
| **Head of Department** | Assoc. prof. PhD. Eng. Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Industrial Machinery and Equipment |
| 1.4. Field of study | Mechatronics and robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | Computer programming and programming languages 1 | Code | FING.MEI.MCTEN.L.FO.1.2020.E-4.3 | | |
| 2.2. Course coordinator | Prof.dr.ing. Marius Cioca | | | | |
| 2.3. Seminar/laboratory coordinator | Prof.dr.ing. Marius Cioca | | | | |
| 2.4. Year of study[2] | 1 | 2.5. Semester[3] | 1 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | R | 2.8. The formative category of the course[6] | | | F |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 11 |
| Additional learning by using library facilities, electronic databases and on-site information | 11 |
| Preparing seminars / laboratories, homework, portfolios and essays | 30 |
| Tutorial activities[9] | 10 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **52** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **108** |
| **3.6. No. of Hours / ECTS** | **27** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Not applicable |
| 4.2. Competencies | Computer operating skills (minimal) |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Classroom equipped with whiteboard, laptopm, projector |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Laboratory room equipped with computers |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **6.2. Transversal competencies** | | | |
| | | | |
| | | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | • Presentation of the Internet and Web domain-specific tools.<br>• Introduction to represent documents in HTML and XHTML.<br>• Tools and technologies needed to achieve and update a site ("Site") web. JavaScript topics will be addressed in conjunction with HTML, cascading style sheets, forms, calculations etc. |
| 7.2. Specific course objectives | For course:<br>• Acquisition and deepen the students of specialized knowledge on building and managing information from a website.<br>• The review, design and implementation of web applications using programming languages description used for this purpose - HMTL, CSS and JavaScript.<br>For applications:<br>• Development of applications like dynamic websites |

**8. Content**

| **8.1. Lectures**[20] | **Teaching methods**[21] | **Hours** |
|---|---|---|
| Lecture 1. Introduction - general, Internet; Client-Server Technology, W3C | lecture (teaching classical presentation to the board and computer use / projector) - questioning - encouraging the expression and active involvement of students in the act of reception knowledge transmitted | 2 |
| Lecture 2. HTML language - working tools; validation tools; basic tags; | | 2 |
| Lecture 3. HTML language - lists; paragraphs; links and anchors; | | 2 |
| Lecture 4. HTML language - images; tables; | | 2 |
| Lecture 5. HTML - forms; methods of data transmission | | 2 |
| Lecture 6. Cascading Style Sheets (CSS) - definition; attributes; | | 2 |
| Lecture 7. Cascading Style Sheets (CSS) - syntax; support; External CSS; work with frames | | 2 |
| Lecture 8. JavaScript language - generalities, introduction; benefits; | | 2 |
| Lecture 9. JavaScript language - syntax rules and basics; variable; | | 2 |
| Lecture 10. JavaScript language - arrays; operators; selection, rehearsal, break instructions; continue; | | 2 |
| Lecture 11. JavaScript language - functions; | | 2 |
| Lecture 12. JavaScript language - events; | | 2 |
| Lecture 13. JavaScript language - objects; properties; methods | | 2 |
| Lecture 14. General recapitulation | | 2 |
| | **Total lecture hours:** | **28** |

| **8.2. Practical activities** (8.2.a. Seminar[22]/ 8.2.b. Laboratory[23]/ 8.2.c. Project[24]) | **Teaching methods** | **Hours** |
|---|---|---|
| Act.1. Install editor for writing HTML code. The first examples | - conducting exercises, applications, problems (solved with the participation of students):<br>- heuristic conversation<br>- questioning<br>- explanation of teaching | 2 |
| Act.2. working tools; validation tools; basic tags; | | 2 |
| Act.3. lists; paragraphs; links and anchors; examples, applications | | 2 |
| Act.4. images; tables; examples, applications | | 2 |
| Act.5. forms; data transmission methods; examples, applications | | 2 |
| Act.6. syntax; support; External CSS; CSS integration in HTML; examples, applications; (1 hour evaluation) | | 2 |
| Act.7. working with frameworks; examples, applications | | 2 |
| Act.8. JavaScript; variable; editor, general syntax | | 2 |
| Act.9. Javascript; arrays; operators; selection, repetition instructions, | | 2 |
| Act.10. Javascript; functions; examples, applications (1 hour evaluation) | | 2 |
| Act.11. Javascript; events, examples | | 2 |
| Act.12. Javascript; javascript objects, examples; applications | | 2 |
| Act.13. Integrate javascript into an HTML site | | 2 |
| Act.14. Recapitulation; synthesis problems | | 2 |
| **Total seminar/laboratory hours:** | | 28 |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | **Cioca, M.** (2009) "*Limbaje de programare*", Editura Universităţii "Lucian Blaga" din Sibiu; |
| | **Cioca, M.**, ş.a.m.d. (2005) "*Programarea animatiilor Web folosind Flash*" Editura Universităţii "Lucian Blaga" din Sibiu; |
| | **Cioca, M.**, ş.a.m.d. (2004) "*Elemente de Web Design*" Editura Universităţii "Lucian Blaga" din Sibiu; |
| | **Cioca, M.** (2003) "*Programarea in PHP si MySQL*", Editura Universitatii "Lucian Blaga" din Sibiu; |
| 9.2. Additional Bibliography | Buraga, S. (2003) *Aplicaţii Web la cheie. Studii de caz implementate în PHP*, Editura Polirom |
| | Buraga, S. (2005) *Proiectarea siturilor Web – ediţia a doua*, Polirom |
| | Anghel, T. (2007) *Programare Web* – Traian Anghel, Editura Polirom |
| | https://www.w3schools.com/ |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

Course content is consistent with what is done in other universities in the country and abroad. To better adapt to market demands discipline content held meetings with representatives of both business (industry) but also with companies specialized in IT and with colleagues from other Romanian universities.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 2 (week 6 and week10) | % (minimum 5) | |
| | | Homework: | 1 | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | % (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | % (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | 50% (minimum 5 grade) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_2_|_7_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_0_|_2_| / |_1_|_0_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Prof.dr.ing. Marius CIOCA | |
| **Study Program Coordinator** | Ş.l.dr.ing. Crengăniş Mihai | |
| **Head of Department** | Conf.dr.ing. Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics (in English) |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Probability theory and statistics | Code | MCTEN.203.FO |

| | | | | | |
|---|---|---|---|---|---|
| 2.2. Course coordinator | Associate Professor PhD. Mihaela Oleksik | | | | |
| 2.3. Seminar/laboratory coordinator | Associate Professor PhD. Mihaela Oleksik | | | | |
| 2.4. Year of study[2] | 1 | 2.5. Semester[3] | 2 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | F |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 1 | 1 | 0 | 0 | 0 | **2** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 14 | 14 | 0 | 0 | 0 | **28** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 18 |
| Additional learning by using library facilities, electronic databases and on-site information | 9 |
| Preparing seminars / laboratories, homework, portfolios and essays | 6 |
| Tutorial activities[9] | 10 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **47** |
| **3.4. Total Hours in the Curriculum *(NOAD$_{sem}$)*** | **28** |
| **3.5. Total Hours per Semester[12] *(NOAD$_{sem}$ + NOSI$_{sem}$)*** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | |
| 4.2. Competencies | |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Room equipped with black board and laptop, projector, computers and appropriate software. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Room equipped with black board and laptop, projector, computers and appropriate software. |

**6. Specific competences acquired[17]**

| Number of credits assigned to the discipline[18] | | 3 | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competences** | PC1 | Analyse test data | 1 |
| | PC2 | Conduct quality control analysis | 1 |
| | PC3 | | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competences** | TC1 | Manage personal professional development | 1 |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | To introduce some of the ideas and methods of probability and statistics and their applications in a variety of engineering settings, watching the whole process of collecting, processing and data analysis. |
| 7.2. Specific course objectives | Working with concepts, methods and mathematical models, specific applications in engineering.<br>Processing, analysis and interpretation of data using statistical tools |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Statistics – tool for knowledge and management.<br>Moments in the evolution of statistics.<br>Scope and method of statistics.<br>Basic concepts used in statistics. | lecture, exemplification | 2 |
| Lecture 2 | Statistical observation.<br>Design of statistical observation.<br>Methods of statistical observation (data collection). | lecture, exemplification | 2 |
| Lecture 3 | Primary processing of statistical data.<br>Systematization and presentation of data: introduction, classification and grouping of data.<br>Statistical series, distribution series, chronological (timed or dynamic) series and territorial (space) series.<br>Statistical tables. Statistical charts. | lecture, exemplification | 2 |
| Lecture 4 | Secondary processing of statistical data<br>Statistical indicators, generalities. | lecture, exemplification, | 2 |

| | | | |
|---|---|---|---|
| | Indicators of central tendency: calculated averages (arithmetic mean, harmonic mean, geometric mean and square mean) and positional averages (median, quartiles and percentile; mode). | solving exercises | |
| Lecture 5 | Indicators of variability: simple indicators of variability (amplitude of variation, interquartile and deviation, individual deviation); complex indices of variability (linear standard deviation, dispersion, standard deviation, coefficient of variation).<br>Indicators of distribution shape: indicators of asymmetry (skewness) | lecture, exemplification, solving exercises | 2 |
| Lecture 6 | Probability and random variables.<br>Basic probability concepts. Experiment. Trial. Outcome. Sample Space. Event.<br>Random variables and probability distributions.<br>Some important discrete and continuous distributions | lecture, exemplification | 2 |
| Lecture 7 | Analysis of the links between statistical variables. Types of statistical links.<br>Course summary. | solving exercises | 2 |
| | | **Total lecture hours:** | **14** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | Basic concepts and terms used in statistics. | exemplification | 2 |
| Seminar 2 | Introduction to Minitab software packages.<br>Systematization and presentation of data. | solving exercises with Minitab | 2 |
| Seminar 3 | Indicators of central tendency: calculated averages (arithmetic mean, harmonic mean, geometric mean and square mean) and positional averages (median, quartiles and percentile, mode). | solving exercises with Minitab | 2 |
| Seminar 4 | Indicators of variability: simple indicators of variability (amplitude of variation, interquartile, deviation, individual deviation); complex indices of variability (linear standard deviation, dispersion, standard deviation, coefficient of variation). | solving exercises with Minitab | 2 |
| Seminar 5 | Indicators of distribution shape: indicators of asymmetry (skewness) and indicators of flattening (kurtosis). | solving exercises with Minitab | 2 |
| Seminar 6 | Basic probability concepts. Probability calculation. | solving exercises | 2 |
| Seminar 7 | Laboratory summary. | solving exercises | 2 |
| | | **Total seminar hours:** | 14 |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Oleksik, M. Ubiquitos Statistics and Probability, Teora USA LLC, Maryland, ISBN 978-1-59496-2103, 2023 |
| | Oleksik, M., Roșca, L. Analiza datelor cu Microsoft Excel, Editura Pro Universitaria, ISBN 978-606-26-1690-8 2023 |
| | Brink D, 2008. Statistics Compendium and Exercises, Ventus Publishing ApS |
| | Devore J L, 2004. Probability and Statistics for Engineering and the Sciences, Thomson, 6th ed. |
| | DeCoursey W.J., 2003. Statistics and Probability for Engineering Applications, Newnes, United States of America |
| | Johnson R, 2005. Miller & Freund's Probability and Statistics for Engineers, Pearson 7th ed, University of Wisconsin—Madison |

| | |
|---|---|
| | D.C. Montgomery and G.C. Runger. Applied Statistics and Probability for Engineers. 5th edition, Wiley, 2011. |
| | Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists-9th ed., Prentice Hall |
| 9.2. Additional Bibliography | Roșca, L., Roșca N., Oleksik, M. Introducere în Microsoft Project, Editura Universității „Lucian Blaga" din Sibiu, ISBN 978-606-12-1901-8, 2021 |
| | Mendenhall W and Sincich T, 1995. Statistics for Engineering and the Sciences, Prentice Hall, 4th ed. |
| | Soong T.T, 2004, Fundamentals of probability and statistics for engineers, John Wiley & Sons Ltd, England |
| | Stephen Vardeman and J. Marcus Jobe, 2001. Basic Engineering Data Collection and Analysis, Duxbury-Brooks/Cole |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]**

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[25](1 test during the 8th week): | 25% | 60% (min. 5) | |
| | | Homework: | 15% | | |
| | | Other activities[26]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 40% (min. 5) | |
| 11.5 Minimum performance standard[27] | | | | | 50% min. |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. prof. PhD Mihaela Oleksik | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Prof. PhD Dan MIRICESCU | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# SYLLABUS

*Academic year 2024 - 2025*

## 1. Details about the program

| | |
|---|---|
| 1.1. Higher Education Institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Study cycle[1] | Bachelor |
| 1.6. Specialization | MECHATRONICS |

## 2. Details about the course

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Course name | Numerical methods | | | Cod | MCTEN.206.FO |
| 2.2. Course coordinator | Assoc. Prof. PhD Amelia BUCUR | | | | |
| 2.3. Practical activity coordinator | Assoc. Prof. PhD Amelia BUCUR | | | | |
| 2.4. Year of study[2] | 1 | 2.5. Semester[3] | 2 | 2.6. Type of assessment[4] | E |
| 2.7. Type of disciplinei[5] | Mandatory | 2.8. Formative category of the discipline[6] | | | F |

## 3. Estimated total time

| 3.1. Proportion of the discipline within the curriculum – *number of hours / week* | | | | | |
|---|---|---|---|---|---|
| 3.1.a.Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Proportion of the discipline within the curriculum – *number of hours / week* | | | | | |
| 3.2.a.Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Allocation of time budget for individual study**[8] | **No. hours** |
|---|---|
| Study based on textbook, lecture notes, bibliography and course notes | 20 |
| Additional research: library, specialized electronic platforms and field or on-site investigation and documentation | 10 |
| Preparing for the seminar / laboratorires, home assignments, reports, portfolios and essays | 10 |
| Tutoring[9] | 1 |
| Examinations[10] | 3 |
| **3.3. Total number of hours for individual study**[11] ***(NOSI$_{sem}$)*** | **44** |
| **3.4. Total number of hours in the curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total number of hours per semester**[12] **(*NOAD$_{sem}$* + *NOSI$_{sem}$*)** | **100** |

| | |
|---|---|
| **3.6. No of hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites** (if applicable)

| | |
|---|---|
| 4.1. Prerequisite courses for enrollment to this subject (from the curriculum) [14] | Linear Algebra, Mathematical Analysis |
| 4.2. Competencies | To be able to use Microsoft Word and to be able to access the Internet |

**5. Requirements** (wherever applicable)

| | |
|---|---|
| 5.1. Lecture organization and structure[15] | blackboard, laptop, video projector, graphics tablet, Maple, Matlab |
| 5.2. Organization and structure of practical activities (lab/sem/pr/other) [16] | blackboard, laptop, video projector, graphics tablet, Maple, Matlab |

**6. Specific competencies[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | 4 |
| **6.1. Professional competencies** | PC1 | Applying basic general and speciality technical knowledge for solving technical problems specific for the field of study Mechatronics and Robotics | 2 |
| | PC2 | Creating and using schemes, structural and functional diagrams as well as graphical representations and technical documents specific for the field of study Mechatronics and Robotics | 1 |
| | PC3 | Design, manufacturing and maintenance of subsystems and components of mechatronic systems | |
| | PC4 | Realizing local automation applications in mechatronics and robotics using tyified and non-typified components and partial assemblies as well as CAD resources | |
| | PC5 | Design, manufacturing and maintenance of electronic control susbsystems of mechatronic systems | |
| | PC6 | Computer aided design, manufacturing and maintenance of mechatronic systems by integrating component subsystems (mechanical, electronic, optical, informational subsystem etc.) | |
| **6.2. Transversal competencies** | TC1 | Carrying out professional tasks with precisely identifying goals to be achieved, available resources, conditions for finishing them, work stages, work time and the corresponding deadlines. | 1 |
| | TC2 | Responsible execution of pluridisciplinary team work tasks, with the assumption of roles on various hierachical levels | |
| | TC3 | Identifying the need for continuous training and efficient usage of information sources and of computer-aided resources for communication and professional training (Internet portals, specialized software applications, databases) | |

**7. Course objectives** (reflected by the framework of specific competencies)

| | |
|---|---|
| 7.1. General objective | For the student to know mathematical models in the field of mechatronics. Efficient usage of the tools provided by numerical analysis and of the opportunities for assisted professional training, in an international language. |

| | |
|---|---|
| 7.2. Specific objectives | For the students to understand and apply the tools provided by numerical methods, for solving practical problems. |

**8. Course description**

| **8.1. Lecture**[20] | | **Teaching methods**[21] | **No. of hours** |
|---|---|---|---|
| Lecture 1 | Interpolation. The interpolating polynomial. Lagrange polynomial interpolation. Details about using artificial intelligence for mathematical modeling. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 2 | Hermite polynomial interpolation. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 3 | Trigonometric interpolation. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 4 | Spline interpolation. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 5 | Formulas for the numerical differentiation of functions. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 6 | Classical orthogonal polynomials. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 7 | Formulas for the numerical integration of functions. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 8 | Numerical methods in algebra. Details about polynomiography. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 9 | Numerical methods in optimization. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 10 | Numerical methods in optimization. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 11 | Numerical methods in optimization. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 12 | Numerical methods in solving differential equations, integrals, and equations with partial derivatives. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| Lecture 13 | Numerical methods in solving differential equations, integrals, and equations with partial derivatives. | Participatory lecture, debate, data display, | 2 |

| | | | |
|---|---|---|---|
| | | problem-solving, demonstration. | |
| Lecture 14 | Numerical methods in solving differential equations, integrals, and equations with partial derivatives. | Participatory lecture, debate, data display, problem-solving, demonstration. | 2 |
| | | **Total number of lecture hours:** | **28** |

8.2. **Practical activities**

| **8.2.b. Laboratory** | | **Teaching methods[22]** | **No. of hours** |
|---|---|---|---|
| Lab. 1 | Applications on the topic: Lagrange polynomial interpolation. Details about using artificial intelligence for mathematical modeling. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 2 | Applications on the topic: Hermite polynomial interpolation. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 3 | Applications on the topic: trigonometric interpolation. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 4 | Applications on the topic: spline interpolation. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 5 | Classical orthogonal polynomials-properties. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 6 | Applications on the topic: Formulas for the numerical differentiation of functions. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer | 2 |

| | | | |
|---|---|---|---|
| | | training. Organized teamwork. | |
| Lab. 7 | Mid-semester Test. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 8 | Applications on the topic: Formulas for the numerical integration of functions. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 9 | Applications on the topic: Numerical methods in algebra. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 10 | Applications on the topic: optimization | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 11 | Applications on the topic: optimization | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 12 | Applications on the topic: optimization | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| Lab. 13 | Applications on the topic: Numerical methods in solving differential equations, integrals, and equations with partial derivatives. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |

| | | | |
|---|---|---|---|
| Lab. 14 | Revison -exercises. | Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork. | 2 |
| | | **Total number of hours: laboratory** | **28** |

## 9. Bibliography


| | |
|---|---|
| 9.1. Recommended references | Amelia Bucur, *Numerical methods - topics for lectures and laboratory classes-*, Lucian Blaga of Sibiu Publishing House, 2022 |
| 9.2. Additional references | Steven C. Chapra, Raymond P. Canale, *Numerical Methods for Engineers*, 7th Edition, Kindle Edition, 2015, http://mechfamilyhu.net/download/uploads/mech1442324159 81.pdf |
| | Jeffery R. Chrasnov, *Introduction to Numerical Methods,* The Hong Kong University, 2012 https://www.math.ust.hk/~machas/numerical-methods.pdf |
| | John R.Hauser, *Numerical Methods for Nonlinear Engineering Models*, 2009. Available on-line: http://www.springer.com/engineering/computational+intelligence+and+complexity/book/978-1-4020-9919-9 |
| | K.Atkinson, W.Han, *Teaching numerical analysis using elementary numerical analysis,* 2020*,* http://www.cs.uiowa.edu/~atkinson/ena_master.html |
| | David H. Bailey, Roberto Barrio, and Jonathan M. Borwein, *High precision computation: Mathematical physics and dynamics*, Applied Mathematics and Computation, vol. 218 (2012), pp. 10106–10121. http://dx.doi.org/10.1016/j.amc.2012.03.087 |
| | J.Stoer, R.Bulirsch, *Introduction to Numerical Analysis*, Second Edition, Springer-Verlag, New-York, 1993 http://www.math.uni.wroc.pl/~olech/metnum2/Podreczniki/(eBook)%20Introduction%20to%20Numerical%20Analysis%20-%20J.Stoer,R.Bulirsch.pdf |
| | K.U. Tariq, M.Nadeem, M.Zeeshan, L.Guran, A. Bucur, *On the dynamics of a dual space time fractional nonlinear Schrödinger model in optical fibers,* Results in Physics, vol.51, 2023, 106603 |
| | J. Ahmad,S. Akram, K. Noor, M. Nadeem, A. Bucur, Y.Alsayaad, *Soliton solutions of fractional extended nonlinear schrödinger equation arising in plasma physics and nonlinear optical fiber,* Scientific Reports, 2023 |
| | K.Shabbir, J.Iqbal, A.Bucur; A.A.Zafar, *Analyzing the convergence of a semi-numerical-analytical scheme for non-linear fractional PDEs*, Alexandria Engineering Journal, 2023 |
| | K.Gdawiec,W.Kotarski, A.Lisowska, *Polynomiography Based on the Nonstandard Newton-Like Root Finding Methods*, Abstract and Applied Analysis Volume 2015, Article ID 797594 |
| | K.Gdawiec, *Polynomiography and various convergence tests,* 21st International Conference on Computer Graphics, Visualization and Computer Vision 2013 |
| | T.Young, M.J.Mohlenkamp,*Introduction to Numerical Methods and Matlab Programming for Engineers*, 2023 https://www.math.ohiou.edu/courses/math3600/book.pdf |
| | Matlab (2000). Control System Toolbox for Use with Matlab, Mathworks Inc., Natick, MA |
| | https://www.maplesoft.com/documentation_center/maple18/usermanual.pdf https://www.maplesoft.com/products/maple/free-trial/ |

**10. Correlating the course description with the expectations and requirements of representatives of the epistemic community, professional associations and significant employers and stakeholders related to the study program and the specific area[23]**

The contents of this discipline are in accordance with what is taught in other university centers within the country and from abroad.

**11. Evaluare**

| Type of activity | 11.1 Assessment criteria | 11.2 Assessment methods | | 11.3 Percentage of the final grade | Notes.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Coloquium | • Theoretical and practical knowledge (quantity, correctness,accuracy) | Midterm / ongoing assignments[25]: | 20% (week 7) | 20%+60% (minimum 5) | *CEF* |
| | | Home assignments: | % | | |
| | | Other activities[26]: | % | | |
| | | Final assessment: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of contributions or answers | Proof of contributions, portfolio (scientific papers, syntheses) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of equipment, methods of using specific instruments and tools; assessment of tools or achievements, processing and interpretation of results | • Written questionnaire<br>• Oral examination<br>• Laboratory notebook, experimental work, scientific papers, etc.<br>• Practical demonstrations | | 20% (minimum 5) | *CEF* |
| 11.4d Project | • Quality of achieved project, accuracy of project documentation, rationale and evidence of selected solutions | • Self-assessment, project submission and/or defense<br>• Critical assessment of a project | | % (minimum 5) | |
| 11.5 Minimum performance standard[27] The student must know basic elements of theory and practice, and must be able to solve an easy exercise. | | | | | |

***The course description includes components adapted to SEN (Special Educational Needs) persons, according to their type and degree, at all curricular elements and dimensions (competencies, objectives, course description, teaching methods, alternative assessment), in view of providing and ensuring equitable and fair opportunities to academic education for all students, with special attention to special educational needs.***

Date of submission: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Date of approval in the Department: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Degree, titlle, first name, surname** | **Signature** |
|---|---|---|
| **Course coordinator** | Assoc. Prof. PhD Amelia BUCUR | |
| **Study program coordinator** | | |
| **Director Departament** | Assoc. prof. PhD Claudia GÎRJOB | |

[1] *Licență / Master*
[2] *1-4 pentru licență, 1-2 pentru master*
[3] *1-8 pentru licență, 1-3 pentru master*
[4] *Examen, colocviu sau VP A/R – din planul de învățământ*
[5] *Regim disciplină: O=Disciplină obligatorie; A=Disciplină opțională; U=Facultativă*
[6] *Categoria formativă: S=Specialitate; F=Fundamentală; C=Complementară; I=Asistată integral; P=Asistată parțial; N=Neasistată*
[7] *Este egal cu 14 săptămâni x numărul de ore de la punctul 3.1 (similar pentru 3.2.a.b.c.d.e.)*
[8] *Liniile de mai jos se referă la studiul individual; totalul se completează la punctul 3.37.*
[9] *Între 7 și 14 ore*
[10] *Între 2 și 6 ore*
[11] *Suma valorilor de pe liniile anterioare, care se referă la studiul individual.*
[12] *Suma (3.5.) dintre numărul de ore de activitate didactică directă (NOAD) și numărul de ore de studiu individual (NOSI) trebuie să fie egală cu numărul de credite alocat disciplinei (punctul 3.7) x nr. ore pe credit (3.6.)*
[13] *Numărul de credit se calculează după formula următoare și se rotunjește la valori vecine întregi (fie prin micșorare fie prin majorare*

$$Nr.credite = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credite$$

Unde:

- NOCpSpD = Număr ore curs/săptămână/disciplina pentru care se calculează creditele
- NOApSpD = Număr ore aplicații (sem./lab./pro.)/săptămână/disciplina pentru care se calculează creditele
- TOCpSdP = Număr total ore curs/săptămână din plan
- TOApSdP = Număr total ore aplicații (sem./lab./pro.)/săptămână din plan
- $C_C$/$C_A$ = Coeficienți curs/aplicații calculate conform tabelului

| **Coeficienți** | **Curs** | **Aplicații (S/L/P)** |
|---|---|---|
| Licență | 2 | 1 |
| Master | 2,5 | 1,5 |
| Licență lb. străină | 2,5 | 1,25 |

[14] *Se menționează disciplinele obligatoriu a fi promovate anterior sau echivalente*
[15] *Tablă, videoproiector, flipchart, materiale didactice specifice, platforme on-line etc.*
[16] *Tehnică de calcul, pachete software, standuri experimentale, platforme on-line etc.*
[17] *Competențele din Grilele aferente descrierii programului de studii, adaptate la specificul disciplinei*
[18] *Din planul de învățământ*
[19] *Creditele alocate disciplinei se distribuie pe competențe profesionale și transversale în funcție de specificul disciplinei*
[20] *Titluri de capitole și paragrafe*
[21] *Expunere, prelegere, prezentare la tablă a problematicii studiate, utilizare videoproiector, discuții cu studenții (pentru fiecare capitol, dacă este cazul)*
[22] *Discuții, dezbateri, prezentare și/sau analiză de lucrări, rezolvare de exerciții și probleme*
[23] *Legătura cu alte discipline, utilitatea disciplinei pe piața muncii*
[24] *CPE – condiționează participarea la examen; nCPE – nu condiționează participarea la examen; CEF - condiționează evaluarea finală; N/A – nu se aplică*
[25] *Se va preciza numărul de teste și săptămânile în care vor fi susținute.*
[26] *Cercuri științifice, concursuri profesionale etc.*
[27] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Fundamentals of mechatronic systems | Code | FING.MEI.MCTEN.L.DO.3.2010.C-3.1 |
| 2.2. Course coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | |
| 2.3. Seminar/laboratory coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 7 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum *(NOAD$_{sem}$)*** | **42** |
| **3.5. Total Hours per Semester[12] *(NOAD$_{sem}$ + NOSI$_{sem}$)*** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge: mechatronic |
| 4.2. Competencies | Computer literacy skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Students are not allowed to have their mobile phones open during lectures, seminars, or labs. Additionally, making or receiving phone calls during class, including leaving the room to take personal calls, will not be tolerated. Furthermore, late arrivals to lectures, seminars, or labs are unacceptable, as they disrupt the educational process. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | The term teaching seminar paper holder is established jointly with the students. Do not accept applications for adjournment thereof on grounds other than objective reasons. Also works for late handing seminar / laboratory work will be marked down to 1 pt. / Day of delay. |

**6. Specific competencies acquired[17]**

| | | Number of credits assigned to the discipline[18] | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | The ability to deepen and understand the functionality of a mechatronic system | |
| | PC2 | The ability to combine mechanical, electronic, and control components into a single functional system | |
| | PC3 | Knowledge of selecting, configuring, and integrating sensors and actuators in mechatronic systems | |
| | PC4 | Design prototypes | |
| | PC5 | Develop mechatronic test procedures | |
| | PC6 | Analyze test data | |
| **6.2. Transversal competencies** | TC1 | Manages personal professional development | |
| | TC2 | Synthesizes information | |
| | TC3 | Finds solutions to problems | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Understanding the fundamental concepts of mechatronic systems, developing design and implementation skills, Selecting and integrating sensors and actuators, Applying IoT technology, Implementing real-time control, Hardware configuration of mechatronic systems. |
| 7.2. Specific course objectives | Knowing the definitions and fundamental principles of mechatronic systems, Designing and implementing a functional mechatronic system, Selecting and configuring sensors and actuators, Implementing IoT technology in mechatronic systems, creating a hardware configuration with a microcontroller, Real-time control of mechatronic systems, applying mechatronic systems in flexible automation, Diagnosing and maintaining mechatronic systems. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Mechatronics | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 2 | Structure and Basic Components of Mechatronic Systems | Lecture enhanced | 2 |

| | | | |
|---|---|---|---|
| | | Heuristic conversation explanation | |
| Lecture 3 | Mechanisms of Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 4 | Sensors in Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 5 | Actuators in Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 6 | Control Systems in Mechatronics | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 7 | Designing and Implementing a Mechatronic System | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 8 | Microcontrollers and Their Programming | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 9 | Controlling Mechatronic Systems with PLC | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 10 | Internet of Things (IoT) Technology Applied in Mechatronics | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 11 | Flexible and Adaptive Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 12 | Real-Time Control of Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 13 | Diagnosis and Maintenance of Mechatronic Systems | Lecture enhanced Heuristic conversation explanation | 2 |

| | | | |
|---|---|---|---|
| Lecture 14 | Applications and Case Studies in Mechatronics | Lecture enhanced Heuristic conversation explanation | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Introduction to IoT and Setting Up the Development Platform | Theoretical study / practical activities | 2 |
| Laboratory 2 | Integration and Programming of Sensors (Water, Smoke, Gas) | Theoretical study / practical activities | 2 |
| Laboratory 3 | Implementing Visual and Audible Signaling (LEDs and Buzzer) | Theoretical study / practical activities | 2 |
| Laboratory 4 | Integrating the Wi-Fi Module (ESP8266/ESP32) for IoT Connectivity and Configuring Tuya | Theoretical study / practical activities | 2 |
| Laboratory 5 | Developing the Mobile Application with Tuya | Theoretical study / practical activities | 2 |

| | | | |
|---|---|---|---|
| Laboratory 6 | Implementing Alarm and Automation Systems in Tuya | Theoretical study / practical activities | 2 |
| Laboratory 7 | Testing, Integration, and Finalization of the Smart Monitoring Project | Theoretical study / practical activities | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | DUMITRIU, Adrian. Bazele sistemelor mecatronice. Brasov: Reprografia Universitatii Transilvania,2006 |
| | Ion Bogdan, Mihai Voicu, Mecatronică și robotică, Editura MatrixRom, București, 2011 |
| | Constantin Buiu, Doru Ursutiu, Sisteme de control automate, Editura Universității Transilvania, Brașov, 2015. |
| | Nicolae Tudoroiu, Senzori și actuatori în mecatronică, Editura Universității din Pitești, Pitești, 2010. |
| | Cristian Lazăr, Andrei Ciuprina, Elemente de proiectare în mecatronică, Editura MatrixRom, București, 2018. |
| | Vasile Stănescu, IoT și Automatizări Industriale, Editura Tehnică, București, 2020. |
| | John Turner, Martyn Austin, Mechatronics: Integrated Technologies for Intelligent Machines, Butterworth-Heinemann, Oxford, 2021. |
| | Clarence W. de Silva, Sensors and Actuators: Control System Instrumentation, CRC Press, Boca Raton, 2007. |
| | W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Pearson, London, 2015. |
| | |
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| | |
| | |
| 9.2. Additional Bibliography | Godfrey C. Onwubolu, Mechatronics: Principles and Applications, Elsevier, Amsterdam, 2005. |
| | David G. Alciatore, Michael B. Histand, Introduction to Mechatronics and Measurement Systems, McGraw-Hill, New York, 2012. |
| | Robert H. Bishop, The Mechatronics Handbook, CRC Press, Boca Raton, 2002. |
| | Dan Necsulescu, Mechatronics: An Integrated Approach, Prentice Hall, Upper Saddle River, 2002. |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

Lectures and case studies,
Projects

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 70% (minimum 5) | Write |
| | | Homework: | % | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation | • Written questionnaire<br>• Oral response | | 30% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | of tools, processing and interpretation of results | • Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | % (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_0_|_2_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_1_|_8_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | |
| **Study Program Coordinator** | Conf. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Conf. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Baechlor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Electronics | Code | FING.MEI.MCTEN.L.DO.3.2010.C-3.2 |
| 2.2. Course coordinator | PhD. Adrian Georgescu | | |
| 2.3. Seminar/laboratory coordinator | Assist. prof. Iosif Adrian MAROȘAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 7 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Basic knowledge about electricity, and physical phenomena |
| 4.2. Competencies | Computer literacy skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Students will not be present at lectures, seminars / labs mobile phones open. Also, phone calls will not be tolerated during the course, nor by students leaving the classroom to retrieve personal phone calls; Students will not be tolerated delay the course and seminar / laboratory since it proves disruptive to the educational process; |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned works. Active participation |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Acquiring basic knowledge and mastering methods of approaching and solving circuits with nonlinear elements; | |
| | PC2 | Perform data analysis | |
| | PC3 | Awareness of the main limitations and advantages of analog electronics; | |
| | PC4 | Acquiring practical skills in using the characteristics of semiconductor devices; | |
| | PC5 | Acquisition of practical skills and abilities in working with the main laboratory devices and in the physical realization of electronic circuits | |
| | PC6 | Develop electronic test procedures | |
| **6.2. Transversal competencies** | TC1 | Manage personal professional development | |
| | TC2 | Synthesise information | |
| | TC3 | Create solutions to problems | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring information on analog components of electronics, operation and practical skills in using the characteristics of semiconductor devices |
| 7.2. Specific course objectives | Acquisition of practical skills and abilities in working with the main laboratory devices and in the physical realization of electronic circuits |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Essentials about electrical circuits They are summarized, the classification of circuits and electrical regimes, as well as the main methods for solving important operating regimes (direct current, alternating current, mixed regime, periodic non-sinusoidal regime). Fundamental elements related to the measurement of electrical quantities are also presented. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 2 | Notions of semiconductor physics The structure of the atom and crystals. Intrinsic semiconductors. Extrinsic semiconductors. Semiconductor transport mechanisms | Lecture enhanced Heuristic conversation explanation | 2 |

| | | | |
|---|---|---|---|
| Lecture 3 | Semiconductor diodes The junction pn. Directly polarized diode. Reverse polarized diode. The ideal diode equation. The actual characteristic of the diode. Diode circuits in direct current mode. Diode equivalence with linear circuit elements. Grapho-analytical methods. Dioda Zenner. Symbol; Characteristic; Operation. Temperature behavior. Catalog data. Application. Parametric stabilizer with Zenner diode. High signal variable diode. Rectifier diode. Diode in alternating current mode, small signal. The pn junction in dynamic regime. Application. Dioda Varicap. Switching diode. Reverse switching. Direct switching Schottky diode. Thermal resistance | Lecture enhanced Heuristic conversation explanation | 4 |
| Lecture 4 | The bipolar transistor Physical processes. Fundamental relations. Bipolar transistor in direct current mode. Theoretical static characteristics. Real static characteristics. Bipolar transistor limit sizes. Equivalent circuits for direct current TB. Polarization circuits. Solving circuits in cc. Behavior of TB with temperature. Bipolar transistor in low signal alternating current mode. Amplifier with a bipolar transistor. The notion of connection. Scheme equivalent to "h" parameters for TB. Calculation of the amplification using the parameters "h". Giacoletto equivalent scheme. TB in alternating current low signal, high frequency. Bipolar transistor in high signal alternating current mode. Switching bipolar transistor Direct switching. Reverse switching | Lecture enhanced Heuristic conversation explanation | 4 |
| Lecture 5 | Unipolar transistors Junction field effect transistor (TECJ). The characteristics of the TECJ. TECJ in direct current regime. TECJ in alternating current regime. TECMOS with initial channel. Metal-Oxide-Semiconductor structure. TECMOS: Structure; Symbol; Operation. TECMOS features with initial channel. TECMOS with induced channel. TECMOS: Structure; Symbol; Operation. TECMOS features with initial channel. TECMOS polarization with initial channel. TECMOS protection. Other devices based on MOS structures. TECMOS in integrated circuit technology. The VMOS transistor. The IGBT transistor. DIFMOS transistors. Load transfer devices. TECMOS, switch in analog circuits. Parameters of analog switches TECMOS in switching mode in analog circuits. | Lecture enhanced Heuristic conversation explanation | 4 |
| Lecture 6 | Optoelectronic devices Photometric quantities Photodiode. Photocell. The phototransistor. LED. The optocoupler. Liquid crystals | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 7 | Voltage, current, transadmittance, distortion, noise amplifiers. Amplifiers with two transistors: cascode, differential, lington transistors. Negative reaction to amplifiers. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 8 | Operational amplifier (AO) The ideal operational amplifier. The actual operational amplifier. Linear applications with AO: Inverter amplifier, non-inverter. Voltage-current converters, Voltage stabilizers Active filters. Nonlinear applications with AO: Comparators Function generators, Analog multipliers | Lecture enhanced Heuristic conversation explanation | 6 |

| | | | |
|---|---|---|---|
| Lecture 9 | Circuits at the interface between the analog signal and the digital computer Galvanic isolation circuits (with optocouplers, with transformer coupling). Notions of electromagnetic compatibility. Digital-to-analog converters, Sampling and storage circuits. | Lecture enhanced Heuristic conversation explanation | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Laboratory equipment, power supplies, signal generators, periodic signals, analog oscilloscope. | Theoretical study / practical activities | 2 |
| Laboratory 2 | Diode. Static characteristics. Diode switching. | Theoretical study / practical activities | 2 |
| Laboratory 3 | Diode rectifiers. Filtration of rectified voltage. | Theoretical study / practical activities | 2 |
| Laboratory 4 | Transistors. Static characteristics. Switching transistors | Theoretical study / practical activities | 2 |
| Laboratory 5 | DC transistors. Polarization schemes | Theoretical study / practical activities | 2 |

| | | | |
|---|---|---|---|
| Laboratory 6 | Elementary amplifiers with bipolar transistor: common emitter, common base, common collector. | Theoretical study / practical activities | 2 |
| Laboratory 7 | Applications with operational amplifiers (AO): reversing amplifier, non-reversing amplifier, hysteresis comparators. | Theoretical study / practical activities | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | I. P. Mihu - Dispozitive şi circuite electronice, vol I, Editura Universităţii "Lucian Blaga", Sibiu, 1997. |
| | I. P. Mihu - Dispozitive si circuite electronice, vol II, Editura Universităţii "Lucian Blaga", Sibiu, 1998. |
| | E. Toma - Electronică analogică, Indrumător de laborator, U.T.Cluj-Napoca, 1998, Tempus Project: S_JEP 11518-96. |
| | I. P. Mihu - Teste şi probleme de electronică, Editura Universităţii "Lucian Blaga", Sibiu, 1998. |
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| 9.2. Additional Bibliography | N. Tomescu, I. Sztojanov, S. Paşca – Electronică analogică şi digitală, Editura Albastră, Cluj Napoca, 2004. |
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| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| Lectures and case studies,<br>Projects |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 70% (minimum 5) | Write |
| | | Homework: | % | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the | • Self-evaluation, project presentation | | % (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | project documentation, the appropriate justification of the chosen solutions | • Critical evaluation of a project | | |
| 11.5 Minimum performance standard[29] | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_0_|_8_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_1_|_4_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | PhD Adrian Georgescu | |
| **Study Program Coordinator** | Conf. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Conf. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Mechanics | Code | FING.MEI.MCTEN.L.DO.3.3210.E-7.4 |
| 2.2. Course coordinator | Lecturer eng. Cristian Matran, PhD. | | |
| 2.3. Seminar/laboratory coordinator | Lecturer eng. Cristian Matran, PhD. | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 3 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | R | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 3 | 2 | 1 | 0 | 0 | **6** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 42 | 28 | 14 | 0 | 0 | **84** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 37 |
| Additional learning by using library facilities, electronic databases and on-site information | 18 |
| Preparing seminars / laboratories, homework, portfolios and essays | 20 |
| Tutorial activities[9] | 14 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*** | **91** |
| **3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*** | **84** |
| **3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*** | **175** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **7** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | ● Knowledge of Algebra<br>● Knowledge of Mathematical Analysis |
| 4.2. Competencies | ● Using the math device |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Active participation;<br>• Delay of students in the course and seminar / laboratory will not be tolerated as it proves to be disruptive to the educational process.<br>• Students during the course, and at lectures, laboratories, it is recommended not to use mobile phones in order to take personal phone calls; (exceptions, special situations, with prior notice to the teacher)<br>• Reading of the course support. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Reading the recommended bibliography; |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| | | Number of credits assigned to the discipline[18] | 7 |
| **6.1. Professional competencies** | PC1 | Application of fundamental knowledge of general and specialized technical culture to solve technical problems specific to the field of Mechatronics and Robotics | 3 |
| | PC2 | Development and use of schemes, structural and functional diagrams, graphic representations, and technical documents specific to the field of Mechatronics and Robotics | 1 |
| | PC3 | Design, creations, and maintenance of subsystems and components of mechatronic systems | 0.5 |
| | PC4 | Realization of local automation applications in mechatronics and robotics using typed and non-typed components and partial assemblies as well as CAD resources | |
| | PC5 | Design, creations, and maintenance of electronic control subsystems of mechatronic systems | |
| | PC6 | Assisted design, creations, and maintenance of mechatronic systems through the integration of component subsystems (mechanical, electronic, optical, IT, etc.) | 0.5 |
| **6.2. Transversal competencies** | TC1 | Fulfilling professional tasks with exact identification of the objectives to be achieved, the available resources, the conditions for their completion, the work stages, the work time and the related deadlines | 1 |
| | TC2 | Responsible execution of work tasks in a multidisciplinary team with the assumption of roles at different hierarchical levels | 0.5 |
| | TC3 | Identifying the need for continuous training and the effective use of information sources and communication resources and assisted professional training (Internet portals, specialized software applications, databases | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | • The acquisition by students of a general knowledge in the field of statics, kinematics and dynamics.<br>• Developed professional awareness by the fact that the problems approached by students in this applied discipline are concrete. |

| | |
|---|---|
| 7.2. Specific course objectives | • Acquiring general knowledge in the field of body system mechanics, necessary for the development of spatial thinking in concrete areas of Euclid's three-dimensional space, by addressing technical problems in vector mode and subsequent transition to scalar form and in some cases and matrix;<br>• Accustoming students with some practical skills, in case of concrete problems of experimental determinations and fixing through these activities the objective laws of nature that are manifested in the environment; of theoretical notions taught in classes and seminars. |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction. Definitions and simplifying models. Fundamental Concepts and Principles. Statics of Particles. Resultant of n Forces | Lecture | 3 |
| Lecture 2 | Equilibrium of a Particle. Forces in Space. Material point links. The Laws of Dry Friction. Coefficient of Friction | Lecture | 3 |
| Lecture 3 | Rigid Bodies. Equivalent System of Forces. Moment of a Force about a Point. Moment of a Force about a Given Axis. Moment of a Couple. | Lecture | 3 |
| Lecture 4 | Resolution of a Given Force into a Force at O and a Couple. Reduction of a System of Forces to One Force and One Couple. Reduction of a System of Forces to a Wrench. Axis of the Wrench. | Lecture | 3 |
| Lecture 5 | Distributed Forces: Centroids and Centres of Gravity. Theorems of Pappus - Guldinus. Equilibrium of Rigid Bodies. Free Body Diagrams. Reactions at supports and Connections for a Two- and Three Dimensional Structure. | Lecture | 3 |
| Lecture 6 | Journal Bearing. Axle Friction. Thrust Bearing. Disk Friction. Belt Friction. Analysis of Structures. Analysis of Trusses a. by the Metod of Joints, b. by the Method of Sections. Analysis of a Frame | Lecture | 3 |
| Lecture 7 | Kinematics of Particles. Position, Velocity and Acceleration. Rectangular Component of Velocity and Acceleration. Tangential and Normal Components. | Lecture | 3 |
| Lecture 8 | Rectilinear Motion of Particles. Curvilinear Motion of Particles. Kinematics of Rigid Bodies. Position, Velocity and Acceleration. Rectangular Component of Velocity and Acceleration. Translation. Rotation about a Fixed Axis. | Lecture | 3 |
| Lecture 9 | Equations Defining the Rotation of a Rigid Body About a Fixed Axis. Instantaneous Centre of Rotation in Plane Motion. Kynetics of Particles. Newton's Second Law | Lecture | 3 |
| Lecture 10 | Distributed Forces: Moments of Inertia. Moments of Inertia of Areas. Moments of Inertia of a Mass. | Lecture | 3 |
| Lecture 11 | Kinetics of Particles: Energy and Momentum Methods. Kinetic Energy of a Particle. Potential Energy | Lecture | 3 |
| Lecture 12 | Systems of Particles. Kinetic Energy of a System of Particles. Conservation of Momentum for a system of Particles. | Lecture | 3 |
| Lecture 13 | Kinematics of Rigid Bodies. Plane Motion of Rigid Bodies. Forces and Accelerations. Plane Motion of Rigid Bodies: Energy and Momentum Methods. Principle of Work and Energy for a Rigid Body. | Lecture | 3 |
| Lecture 14 | Kinetics of Rigid Bodies in Three Dimensions. Motion of a Rigid Body in Three Dimensions. Rotation of a Rigid Body about a Fixed Axis | Lecture | 3 |
| | | **Total lecture hours:** | **42** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | Applications to the course topic 1 | Practical application | 2 |
| Seminar 2 | Applications to the course topic 2 | Practical application | 2 |

| | | | |
|---|---|---|---|
| Seminar 3 | Applications to the course topic 3 | Practical application | 2 |
| Seminar 4 | Applications to the course topic 4 | Practical application | 2 |
| Seminar 5 | Applications to the course topic 5 | Practical application | 2 |
| Seminar 6 | Applications to the course topic 6 | Practical application | 2 |
| Seminar 7 | Applications to the course topic 7 | Practical application | 2 |
| Seminar 8 | Applications to the course topic 8 | Practical application | 2 |
| Seminar 9 | Applications to the course topic 9 | Practical application | 2 |
| Seminar 10 | Applications to the course topic 10 | Practical application | 2 |
| Seminar 11 | Applications to the course topic 11 | Practical application | 2 |
| Seminar 12 | Applications to the course topic 12 | Practical application | 2 |
| Seminar 13 | Applications to the course topic 13 | Practical application | 2 |
| Seminar 14 | Applications to the course topic 14 | Practical application | 2 |
| | | **Total seminar hours:** | 28 |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Lecture 1 and 2 applications. | Practical application | 2 |
| Laboratory 2 | Lecture 3 and 4 applications. | Practical application | 2 |
| Laboratory 3 | Lecture 5 and 6 applications. | Practical application | 2 |
| Laboratory 4 | Lecture 7 and 8 applications. | Practical application | 2 |
| Laboratory 5 | Lecture 9 and 10 applications. | Practical application | 2 |
| Laboratory 6 | Lecture 11 and 12 applications. | Practical application | 2 |
| Laboratory 7 | Lecture 13 and 14 applications. | Practical application | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | - | | |
| Project 2 | - | | |
| Project 3 | - | | |
| Project 4 | - | | |
| Project 5 | - | | |
| Project 6 | - | | |
| Project 7 | - | | |
| Project 8 | - | | |

| | | | |
|---|---|---|---|
| Project 9 | - | | |
| Project 10 | - | | |
| Project 11 | - | | |
| Project 12 | - | | |
| Project 13 | - | | |
| Project 14 | - | | |
| | | **Total project hours:** | 0 |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | - | | |
| Act.2 | - | | |
| Act.3 | - | | |
| Act.4 | - | | |
| Act.5 | - | | |
| Act.6 | - | | |
| Act.7 | - | | |
| Act.8 | - | | |
| Act.9 | - | | |
| Act.10 | - | | |
| Act.11 | - | | |
| Act.12 | - | | |
| Act.13 | - | | |
| Act.14 | - | | |
| | | **Total other practical activities hours:** | 0 |

## 9. Bibliography


| | |
|---|---|
| 9.1. Recommended Bibliography | 1. Bercan, N., Matran, C., “Elements of mechanics”, “Lucian Blaga” University Publishing House, Sibiu, 2016. |
| | 2. Bercan, N., Matran, C. – „Introducere în mecanică, Editura universității „Lucian Blaga” din Sibiu, 2020 |
| | 3. Sârbu, N., Gheorghe, I., Bercan, N., “Engineering mechanics”, Lucian Blaga University Publishing House, Sibiu, 1994. |
| | 4. Gheorghe, I., Bercan, N., Gheorghe, R., “Collection of mechanics problems - DYNAMICS”, Lucian Blaga University Publishing House, Sibiu, 2008. |
| | 5. Gheorghe, I., Bercan, N., Pascu, A., “Collection of mechanics problems - STATICS”, Lucian Blaga University Publishing House, Sibiu, 2010. |
| | 6. Gheorghe, I., Bercan, N., “Collection of mechanics problems - CINEMATICS”, Lucian Blaga University Publishing House, Sibiu, 2013. |
| | 7. Gheorghe, I., Bercan, N., Oleksik, V., “Collection of Mechanics-DYNAMICS problems”, “Lucian Blaga” University Publishing House, Sibiu, 2013. |
| | 8. Sârbu, N., Gheorghe, I., Bercan, N., “Laboratory guide of Mechanics and Mechanical Vibrations”, Lucian Blaga University Publishing House, Sibiu, 1996. |
| | 9. Sima, E., “Mechanics”, “Lucian Blaga” University Publishing House, Sibiu, 2017. |
| 9.2. Additional Bibliography | 1. Beer, F.P., Johnston, E.R., “Vector Mechanics for Engineers”, Third Edition, Mc. Graw-Hill Book Company, 1977. |
| | 2. DAVID, J. M., WILTON, W. K., “Engineering Mecanics : Statics and An Introduction to Dynamics”, The Maple - Vail Book Manufacturing Group, Boston, 1989 |
| | 3. McGILL, J. D., KING, W. W., “Engineering Mechanics: Statics and an Introduction to Dynamics”, Boston, 1989. |
| | 4. Sima, E.,”Mechanics”, Impressum Publishing House, Chișinău, 2016. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies. |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 20% | 50% (min 5) | Written Exam |
| | | Homework: | 30% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 50% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 25% | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 25% | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% | |
| 11.5 Minimum performance standard[29] | | | | | 50% |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2025

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Lecturer eng. Cristian Matran, PhD | |
| **Study Program Coordinator** | S.l. dr. ing. Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof., eng. Claudia Gîrjob. PhD | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
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[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
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- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
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[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Architecture of numerical computers | | | Code | MCTEN.305.DO | |
| 2.2. Course coordinator | Lecturer PhD. Gabriela-Petruța POPP | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța POPP | | | | | |
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 3 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 30 |
| Additional learning by using library facilities, electronic databases and on-site information | 18 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Students are required to have general knowledge of digital electronics, number systems, and programming, acquired through prior courses. |
| 4.2. Competencies | - |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Active involvement of students in teaching activities<br>• Availability of teaching support materials |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Active involvement of learners<br>• Preliminary understanding of the main course objectives |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | 4 | Credits distribution by competencies[19] |
|---|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Analyzes test data | | 1 |
| | PC2 | Develops procedures for testing products, systems, and electronic components | | 0.5 |
| | PC3 | Performs analytical mathematical calculations | | 0.5 |
| | PC4 | Synthesizes information | | 0.5 |
| **6.2. Transversal competencies** | TC1 | Manages personal professional development | | 0.5 |
| | TC2 | Finds solutions to problems | | 0.5 |
| | TC3 | Thinks abstractly | | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The general objective of the course is to provide students with theoretical knowledge and practical skills in designing, analyzing, and evaluating modern computer architectures. This includes understanding the basic components of a computing system, their interaction, and optimizing their performance. |
| 7.2. Specific course objectives | At the end of this course, students will be able to:<br>• Analyze the structure and functionality of the main components of computer architectures, such as processing units and memory.<br>• Apply knowledge of different types of architectures (CISC, RISC, parallel architectures) and identify their applications.<br>• Evaluate the performance of a computing system by simulating and interpreting the results obtained from tests and experiments.<br>• Design optimal solutions for specific hardware architecture problems.<br>• Integrate knowledge of programming and digital electronics in the analysis and development of computing systems. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Computer Architecture | Lecture, Heuristic conversation, Explanation, Case study | 2 |
| Lecture 2 | Data Representation | - ” - | 2 |
| Lecture 3 | Structure and Operation of a Processor (Part I: Internal Components of the Processor) | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Structure and Operation of a Processor (Part II: Functional Units and Instruction Execution) | - ” - | 2 |
| Lecture 5 | Memory (Part I: Types of Memory and Internal Memory Organization) | - ” - | 2 |
| Lecture 6 | Memory (Part II: Cache Systems and Memory Access Optimization) | - ” - | 2 |
| Lecture 7 | Secondary Storage Technologies | - ” - | 2 |
| Lecture 8 | Peripheral Devices and I/O Interfaces | - ” - | 2 |
| Lecture 9 | Motherboards: Architecture and Functionality | - ” - | 2 |
| Lecture 10 | Graphics Card Architecture and Graphic Processing | - ” - | 2 |
| Lecture 11 | Parallel and Multicore Architectures | - ” - | 2 |
| Lecture 12 | Performance Optimization and Benchmarking | - ” - | 2 |
| Lecture 13 | Emerging Architectures (ARM, FPGA) | - ” - | 2 |
| Lecture 14 | Specialized Architectures and Hardware Accelerators | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Introduction to Simulation Environments for Computer Architecture and ISA | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Data Representation and Data Manipulation Instructions in ISA | - ” - | 2 |
| Laboratory 3 | Design and Simulation of the Instruction Cycle in ISA | - ” - | 2 |
| Laboratory 4 | Arithmetic and Logical Instructions in ISA | - ” - | 2 |
| Laboratory 5 | Flow Control in ISA: Jumps and Branches | - ” - | 2 |
| Laboratory 6 | Memory and Memory Access Instructions in ISA | - ” - | 2 |
| Laboratory 7 | Instruction Optimization in ISA | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Patterson, D. A., & Hennessy, J. L. (2013). Computer Organization and Design: The Hardware/Software Interface (5th ed.). Morgan Kaufmann. |
| | Stallings, W. (2019). Computer Organization and Architecture: Designing for Performance (11th ed.). Pearson. |
| | Tanenbaum, A. S., & Austin, T. (2012). Structured Computer Organization (6th ed.). Pearson. |

| | |
|---|---|
| | Hamacher, C., Vranesic, Z., & Zaky, S. (2011). Computer Organization and Embedded Systems (6th ed.). McGraw-Hill. |
| 9.2. Additional Bibliography | Mano, M. M., & Ciletti, M. D. (2017). Digital Design: With an Introduction to the Verilog HDL (5th ed.). Pearson. |
| | Hennessy, J. L., & Patterson, D. A. (2019). Computer Architecture: A Quantitative Approach (6th ed.). Morgan Kaufmann. |
| | Harris, D. M., & Harris, S. L. (2012). Digital Design and Computer Architecture (2nd ed.). Morgan Kaufmann. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in both formal and informal settings with representatives of specialized companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 70% (minimum 5) | Minimum attendance: 50% at lectures Exam: written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | Minimum attendance: 100% at laboratories CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Gabriela-Petruța POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Baechlor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Electrotechnics | | | Code | FING.MEI.MCTEN.L.DO.3.2010.E-4.6 | |
| 2.2. Course coordinator | - | | | | | |
| 2.3. Seminar/laboratory coordinator | Assist. prof. Iosif Adrian MAROȘAN | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 17 |
| Preparing seminars / laboratories, homework, portfolios and essays | 12 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum *(NOAD$_{sem}$)*** | **42** |
| **3.5. Total Hours per Semester[12] *(NOAD$_{sem}$ + NOSI$_{sem}$)*** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge of analog electronics, electric motors |
| 4.2. Competencies | Computer literacy skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Students will not be present at lectures, seminars / labs mobile phones open. Also, phone calls will not be tolerated during the course, nor by students leaving the classroom to retrieve personal phone calls; Students will not be tolerated delay the course and seminar / laboratory since it proves disruptive to the educational process; |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned works. Active participation |

**6. Specific competencies acquired[17]**

| | | Number of credits assigned to the discipline[18] | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Knowledge of the fundamental laws and phenomena underlying electrical engineering. Calculation of direct and alternating current circuits. | |
| | PC2 | Construction and operation of electric machines. | |
| | PC3 | Ways of choosing and using electric motors in applications. | |
| | PC4 | Develop electronic test procedures | |
| | PC5 | Execute analytical mathematical calculations | |
| | PC6 | Analyse test data | |
| **6.2. Transversal competencies** | TC1 | Manage personal professional development | |
| | TC2 | Synthesise information | |
| | TC3 | Create solutions to problems | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | the acquisition by the students of the Mechatronics specialization of the basic notions of electrical engineering: fundamental laws, the study of single-phase and three-phase direct and alternating current circuits; construction, operation, fields of use of conventional electric machines; optimizing the operation of electromechanical energy conversion systems. |
| 7.2. Specific course objectives | Acquisition of practical skills and abilities in working with the main laboratory devices and in the physical realization of electronic circuits |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Electrostatics and electrokinetics. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 2 | DC circuits. | Lecture enhanced Heuristic conversation explanation | 2 |

| | | | |
|---|---|---|---|
| Lecture 3 | Electrodynamics. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 4 | Alternating current and sinusoidal circuit elements. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 5 | Single-phase alternating current circuits. Three-phase alternating current circuits | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 6 | Single Phase electrical transformer. Construction and operating principle. Load operation of the transformer. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 7 | The three-phase transformer. Construction, diagrams and connection groups. Parallel operation of transformers | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 8 | The asynchronous machine. Construction and operating principle. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 9 | Asynchronous machine power balance. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 10 | Motor torques of the asynchronous machine. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 11 | DC machine with collector. Construction and principle of operation. Areas of application. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 12 | DC motor operation. Operating equations. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 13 | Synchronous machine. Construction, operating principle. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 14 | Autonomous synchronous generator. Operation of the synchronous generator connected to the network. | Lecture enhanced Heuristic | 2 |

| | | | |
|---|---|---|---|
| | | conversation explanation | |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Measurement of current, voltage and power in direct current circuits and alternating current circuits. | Theoretical study / practical activities | 2 |
| Laboratory 2 | Operation of electrical transformers in load. | Theoretical study / practical activities | 2 |
| Laboratory 3 | Asynchronous motor: starting methods and speed adjustment. | Theoretical study / practical activities | 2 |
| Laboratory 4 | Mechanical characteristic of asynchronous motor. | Theoretical study / practical activities | 2 |
| Laboratory 5 | Study of DC motor with separate excitation. DC motor with permanent magnets. | Theoretical study / practical activities | 2 |
| Laboratory 6 | Study of the autonomous synchronous generator. | Theoretical study / | 2 |

| | | | |
|---|---|---|---|
| | | practical activities | |
| Laboratory 7 | Recoveries. | Theoretical study / practical activities | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Mocanu C. I. – *Teoria circuitelor electrice*, E.D.P., Bucureşti, 1979. |
| | Boldea I. – *Transformatoare şi maşini electrice*, E.D.P., Bucureşti,1994. |
| | Dordea T. – *Maşini electrice (ed. a II-a)*, E.D.P., Bucureşti, 1978. |
| | E. Toma - Electronică analogică, Indrumător de laborator, U.T.Cluj-Napoca, 1998, Tempus Project: S_JEP 11518-96. |
| | Galan N., ş.a. – *Maşini electrice*, E.D.P., Bucureşti, 1983 |
| | Panu M. –*Noţiuni generale de maşini electrice*, Edit. U.L.B. Sibiu, 2001 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| 9.2. Additional Bibliography | Antoniu I.S. – Bazele electrotehnicii, E.D.P. Bucureşti, 1974. |
| | |
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| | |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| Lectures and case studies,<br>Projects |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 70% (minimum 5) | Write |
| | | Homework: | % | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | justification of the chosen solutions | | | |
| 11.5 Minimum performance standard[29] | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_0_|_8_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_1_|_4_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Eng. Neamtu Adrian | |
| **Study Program Coordinator** | Conf. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Conf. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | English language 3 | | Code | MCTEN.307.CA | |
| 2.2. Course coordinator | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD Monica Cojocaru | | | | |
| 2.4. Year of study[2] | II | 2.5. Semester[3] | 3 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | C |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 0 | 2 | 0 | 0 | 0 | **2** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 0 | 28 | 0 | 0 | 0 | **28** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 5 |
| Additional learning by using library facilities, electronic databases and on-site information | 5 |
| Preparing seminars / laboratories, homework, portfolios and essays | 3 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **22** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **28** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **50** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **2** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | English language 1 and 2 |
| 4.2. Competencies | Learning – communication |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Active participation; completing seminar assignments |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Strengthening the skills of understanding a written or spoken text in English | |
| | PC2 | Developing a specialized vocabulary | |
| | PC3 | The development of oral and written expression skills in English | |
| | PC4 | Developing the ability to synthesize and organize a written or oral message | |
| | PC5 | The development of oral and written communication skills in a socio-professional environment | |
| **6.2. Transversal competencies** | TC1 | Cultivating creativity, encouraging flexible thinking | |
| | TC2 | Strengthening teamwork skills | |
| | TC3 | Identification of opportunities for continuous training and effective use of learning resources and techniques for personal development | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Improving skills in English<br>The understanding, use and application of specialized terminology |
| 7.2. Specific course objectives | Familiarizing students with:<br>• Specialized vocabulary<br>• Improving knowledge of English, both written and especially spoken<br>• Translation of specialized texts<br>• Oral communication on specialized topics |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | | | |
| Lecture 2 | | | |
| Lecture 3 | | | |
| Lecture 4 | | | |
| Lecture 5 | | | |
| Lecture 6 | | | |
| Lecture 7 | | | |
| Lecture 8 | | | |
| Lecture 9 | | | |

| | | | |
|---|---|---|---|
| Lecture 10 | | | |
| Lecture 11 | | | |
| Lecture 12 | | | |
| Lecture 13 | | | |
| Lecture 14 | | | |
| | | **Total lecture hours:** | |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | Mecanisms: reading, language study, speaking practice | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 2 | Forces in Engineering: reading, language study, listening | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 3 | The Electrical Motor: reading, language study, word study | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 4 | Portable Generator: technical reading, language study, word study | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 5 | Computer Aided Design (CAD): listening, language study | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 6 | Graphs: language study, word study, technical reading | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 7 | Robotics: language study, technical reading | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 8 | Technical Development: language study, listening, technical reading | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 9 | Health and Safety Precautions: listening, reading, language study | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 10 | Company structure: language study, technical reading | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 11 | Careers in Engineering: reading, speaking practice, listening | Oral presentation; Specialized texts in English; follow-up vocabulary exercises | 2 |
| Seminar 12 | Applying for a Job: reading, speaking practice, writing | Oral presentation; Specialized texts in | 2 |

| | | | |
|---|---|---|---|
| | | English; follow-up vocabulary exercises | |
| Seminar 13 | Round-up exercises | | 2 |
| Seminar 14 | Test | | 2 |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | … | | |
| Laboratory 2 | … | | |
| Laboratory 3 | | | |
| Laboratory 4 | | | |
| Laboratory 5 | | | |
| Laboratory 6 | | | |
| Laboratory 7 | | | |
| Laboratory 8 | | | |
| Laboratory 9 | | | |
| Laboratory 10 | | | |
| Laboratory 11 | | | |
| Laboratory 12 | | | |
| Laboratory 13 | | | |
| Laboratory 14 | | | |
| | | **Total laboratory hours:** | |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |

| | | | |
|---|---|---|---|
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| **Total other practical activities hours:** | | | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Ibbotson, Mark. *Cambridge English for Engineering*. Cambridge University Press, 2008 |
| | Glendinning, Eric H. And Norman Glendinning. *Oxford English for Electrical and Mechanical Engineering*. Oxford University Press, 1995. |
| | Ibbotson Mark. *Professional English in Use. Engineering. Technical English for Professionals*. Cambridge University Press, 2009. |
| 9.2. Additional Bibliography | Further texts from specialized literature in the field of study |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

The development of oral and written communication skills in an appropriate socio-professional environment. Applying these skills to appropriate activities for the employer and the community.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 100% (minimum 5) | |
| | | Homework: | 30% | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | % (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | justification of the chosen solutions | | | |
| 11.5 Minimum performance standard[29] | | | | 50% minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD Monica Cojocaru | |
| **Study Program Coordinator** | Lecturer PhD Monica Cojocaru | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | **Faculty of Engineering** |
| 1.3. Department | **Department of Machines and Industrial Equipment** |
| 1.4. Field of study | **Mechatronics and Robotics** |
| 1.5. Level of study[1] | **Bachelor** |
| 1.6. Programme of study/qualification | **MECHATRONICS** |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | **Technical Thermodynamics** | | | Code | MCTEN.401.DO |
| 2.2. Course coordinator | **Assoc. prof. PhD Claudiu ISARIE** | | | | |
| 2.3. Seminar/laboratory coordinator | **Assoc. prof. PhD Claudiu ISARIE** | | | | |
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 4 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 5 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*** | **42** |
| **3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | N/A |
| 4.2. Competencies | Computer operating knowledge,<br>Basic knowledge of Physics,<br>Mathematical analysis-integral and differential calculus |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Board, video projector, online platforms,<br>Active participation |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Board, video projector, specific teaching materials, online platforms,<br>Active participation |

**6. Specific competencies acquired[17]**

| | | | Număr de credite alocat disciplinei[18] 3 | Repartizare credite pe competențe[19] |
|---|---|---|---|---|
| **6.1. Competențe profesionale** | CP1 | analyse test data | | 0,5 |
| | CP2 | approve engineering design | | 0,5 |
| | CP3 | conduct quality control analysis | | 0,25 |
| | CP4 | perform test run; | | 0,25 |
| | CP5 | keep up with digital transformation of industrial processes; | | 0,25 |
| | CP6 | use CAD software; | | 0,25 |
| **6.2. Competențe transversale** | CT1 | manage personal professional development | | 0,25 |
| | CT2 | think abstractly | | 0,25 |
| | CT3 | speak different languages | | 0,5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | This course is an introduction to the principal concepts and methods of thermodynamics and heat transfer. The course consists of lectures and practical exercises. |
| 7.2. Specific course objectives | Knowledge and proper use of terms specific to thermodynamics;<br>Knowledge of the principles of thermodynamics;<br>Understanding the operation of thermal machines. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Concept of a thermodynamic system | Heuristic conversation, explanation. | 2 |
| Lecture 2 | The principles of thermodynamics | - ” - | 2 |
| Lecture 3 | Perfect and real gases | - ” - | 2 |
| Lecture 4 | Thermodynamic processes with vapors | - ” - | 2 |
| Lecture 5 | Transmission of heat | - ” - | 2 |
| Lecture 6 | Thermal conduction | - ” - | 2 |
| Lecture 7 | Convection | - ” - | 2 |
| Lecture 8 | Thermal radiation | - ” - | 2 |
| Lecture 9 | Heat exchangers | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 10 | Compressors | - ” - | 2 |
| Lecture 11 | Engines with internal combustion | - ” - | 2 |
| Lecture 12 | Wet air | - ” - | 2 |
| Lecture 13 | Wet air processes | - ” - | 2 |
| Lecture 14 | Heat pumps. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

| **8.2.a. Practical activities** Laboratory[22] | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Lab. 1 | Work safety norms in the laboratory. Introduction. Measurement proceses. | Theoretical study / Practical applications | 2 |
| Lab. 2 | Temperature measurement | - ” - | 2 |
| Lab. 3 | Pressure measurement | - ” - | 2 |
| Lab. 4 | Fluid flow rate measurement | - ” - | 2 |
| Lab. 5 | Air humidity parameters | - ” - | 2 |
| Lab. 6 | Experimental study of convection heat transfer | - ” - | 2 |
| Lab. 7 | Synthesis and evaluation | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | 1. Petrilean, D. C. *Termodinamica tehnica si masini termice* Editura: A.G.I.R., Seria: Cursuri universitare. Masterat, 356 p., 2010, ISBN: 978-973-720-328-1. |
| | 2. Isarie, C., *Termotehnica*, Editura Universităţii "Lucian Blaga" din Sibiu, re-ed. 2011; |
| | 3. Yunus A. Çengel and Michael A. Boles., *Thermodynamics: An Engineering Approach*,5th edition, 874 p, 2015 |
| 9.2. Additional Bibliography | 1. Foanene, A., *Bazele termodinamicii tehnice. Îndrumar de laborator*, Ed. „Academica Brancusi”, 84 p, 2017. |
| | 2. Duroudier, J.P., *Thermodynamics*, 1st Edition, ISTE Press – Elsevier, 290 p. 2016, ISBN: 9781785481765, eBook ISBN: 9780081017890. |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[24]

Design and implementation of activities, research projects in order to apply skills acquired in the studied discipline.
The content of the discipline is in accordance with what is presented in other university centers in the country and abroad.
It is carried out through regular discussions in a formal and informal setting with the representatives of engineering profile companies.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[25] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[26]: | 30 % | 70 % (minimum 5) | CPE |
| | | Homework: | 5 % | | |
| | | Other activities[27]: | 5 % | | |
| | | Final evaluation: | 60 % | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | - | N/A |

| | | | | |
|---|---|---|---|---|
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | 30 % (minimum 5) | CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | - | N/A |
| 11.5 Minimum performance standard[28] | | | | 50 % (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | **Assoc. prof. PhD Claudiu ISARIE** | |
| **Study Program Coordinator** | **Assoc. prof. PhD Mihai CRENGANIS** | |
| **Head of Department** | **Assoc. prof. PhD Claudia GÎRJOB** | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *Din planul de învățământ*
[19] *Creditele alocate disciplinei se distribuie pe competențe profesionale și transversale în funcție de specificul disciplinei*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[24] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[25] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[26] *The number of tests and the weeks in which they will be taken will be specified*
[27] *Scientific circles, professional competitions, etc.*
[28] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Power electronics | Code | FING.MEI.MCTEN.L.DO.4.2010.C-3.3 |
| 2.2. Course coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | |
| 2.3. Seminar/laboratory coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 7 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Basic knowledge of analog electronics and electrical engineering |
| 4.2. Competencies | Computer literacy skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Students will not be present at lectures, seminars / labs mobile phones open. Also, phone calls will not be tolerated during the course, nor by students leaving the classroom to retrieve personal phone calls; Students will not be tolerated delay the course and seminar / laboratory since it proves disruptive to the educational process; |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned works. Active participation |

**6. Specific competencies acquired[17]**

| | | Number of credits assigned to the discipline[18] | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Understands the correct parametric conversion of electrical energy as well as the conversion of electrical energy into other forms of energy; | |
| | PC2 | Uses the basic elements of power electronics circuits in the analysis and synthesis of parametric converters, with a focus on power semiconductor devices; | |
| | PC3 | Knows the evolution of static converters; | |
| | PC4 | Performs analytical mathematical calculations; | |
| | PC5 | Develops testing procedures for electronic products, systems, and components; | |
| | PC6 | Analyzes test data; | |
| **6.2. Transversal competencies** | TC1 | Manages personal professional development; | |
| | TC2 | Synthesizes information; | |
| | TC3 | Finds solutions to problems; | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | to acquire knowledge in the field of parametric energy conversions electric; to form skills in use with high energy yields a parametric converters of electricity; to form skills in optimizing the electromagnetic processes of the point view of electromagnetic compatibility; to form skills of protection and self-protection of conversion systems parametric; |
| 7.2. Specific course objectives | Acquisition of practical skills and abilities in working with the main laboratory devices and in the physical realization of electronic circuits |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Energy conversions Parametric conversion of electricity. Convert electricity. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 2 | Power semiconductor devices Semiconductor diode. The thyristor. The devil. The triac. The bipolar power transistor. The MOS transistor of power. | Lecture enhanced Heuristic | 2 |

| | | | |
|---|---|---|---|
| | | conversation explanation | |
| Lecture 3 | Power semiconductor devices Bilateral control thyristor (GTO). Bipolar transit with insulated gate (IGBT). MOS controlled transistor (MCT). Static induction transistor and static induction thyristor. Comparisons between power semiconductor devices. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 4 | Switching in electronic circuits with circuits semiconductors. Static switches. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 5 | Alternating current inverters | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 6 | Single-phase converter Single-phase converter with zero. Single - phase converter in deck | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 7 | Three-phase converter Three-phase converter with zero. Three-phase bridge converter. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 8 | Interrupted driving regime | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 9 | Four dial converters. Cyclic converters. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 10 | DC voltage variators | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 11 | Forced switching inverters. Duration modulation of pulse (PWM) | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 12 | INVERTORS PWM voltage inverters. PWM current inverters. Frequency converters. | Lecture enhanced Heuristic conversation explanation | 2 |
| Lecture 13 | Buffer supply. Uninterruptible voltage sources (UPS). Sources for electric arc welding. | Lecture enhanced Heuristic conversation explanation | 2 |

| | | | |
|---|---|---|---|
| Lecture 14 | Energy conversion energy. | Lecture enhanced Heuristic conversation explanation | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | The influence of electric current on the human body. rules labor protection in power electronics laboratory. Study of laboratory devices. | Theoretical study / practical activities | 2 |
| Laboratory 2 | Study of stationary device regimes energy switching semiconductors | Theoretical study / practical activities | 2 |
| Laboratory 3 | Study of BUCK type DC voltage variators. | Theoretical study / practical activities | 2 |
| Laboratory 4 | Study of BOOST type voltage variators | Theoretical study / practical activities | 2 |
| Laboratory 5 | Study of PWM voltage inverters | Theoretical study / practical activities | 2 |

| | | | |
|---|---|---|---|
| Laboratory 6 | Study of switching sources | Theoretical study / practical activities | 2 |
| Laboratory 7 | Study of AC / DC frequency converters | Theoretical study / practical activities | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Kelemen, A. şi col.: Electronică de putere, EDP, Bucureşti 1983 |
| | Ionescu, F. şi col.: Electronică de putere.Convertoare statice. Ed.tehnică |
| | Bucureşti 1996 |
| | Bitoleanu, A.: Convertoare statice şi structuri de comandă performante. |
| | Ed.Sitech Craiova 2000 |
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| 9.2. Additional Bibliography | Ericson, R.W.: Fundamentals of Power Electronics, ED.Chapman and Hall, New York 1997 |
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## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

Lectures and case studies,
Projects

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 70% (minimum 5) | Write |
| | | Homework: | % | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |

| | |
|---|---|
| 11.5 Minimum performance standard[29] | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_0_|_8_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_1_|_4_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | |
| **Study Program Coordinator** | Conf. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Conf. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Tolerances and Dimensional control | Code | MCTEN.404.DO |
| 2.2. Course coordinator | Associate Professor PhD. Mihaela Oleksik | | |
| 2.3. Seminar/laboratory coordinator | Associate Professor PhD. Mihaela Oleksik | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 4 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 22 |
| Additional learning by using library facilities, electronic databases and on-site information | 6 |
| Preparing seminars / laboratories, homework, portfolios and essays | 6 |
| Tutorial activities[9] | 7 |
| Exams[10] | 3 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Technical drawing |
| 4.2. Competencies | |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Board, video projector |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Board, video projector, measuring equipment, online platforms |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | 4 | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Adjust engineering designs | 1 |
| | PC2 | Define technical requirements | 1 |
| | PC3 | Analyse test data | 1 |
| | PC4 | | 0 |
| | PC5 | | 0 |
| | PC6 | | 0 |
| **6.2. Transversal competencies** | TC1 | Coordinate engineering teams | 1 |
| | TC2 | | 0 |
| | TC3 | | 0 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Develop skills in the field of geometrical product specifications (dimensional tolerances, geometric tolerances and geometric surface requirements) and measuring equipment |
| 7.2. Specific course objectives | Knowledge, understanding and application of the main concepts related to dimensional and geometric tolerance, surface condition as well as the development of dexterity in the use of measuring equipment. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction.<br>Dimensions, deviations and dimensional tolerance. | exposition, exemplification, discussions | 2 |
| Lecture 2 | Clearances and interferences.<br>ISO fit systems and types of fits: hole-basis fit system and shaft-basis fit system | exposition, exemplification, discussions | 2 |
| Lecture 3 | Main features of ISO system of tolerances and fits: intervals of nominal sizes, standard tolerance grades, standard (fundamental) tolerance, fundamental deviation, tolerance class | exposition, exemplification, discussions | 2 |
| Lecture 4 | Preferential fits. General recommendations regarding the choice of fits. Calculation of ISO fits, problem solving.<br>Marking limits and fits.<br>General dimensional tolerances | exposition, exemplification, discussions | 2 |
| Lecture 5 | Verification during the semester (Verification 1) | evaluation, discussions | 2 |
| Lecture 6 | Dimensional control with Go-NoGo gages: introduction, basis principle of inspection (Taylor's theory of gauging) | exposition, training in audio-visual, | 2 |

| | | | |
|---|---|---|---|
| | | discussions | |
| Lecture 7 | Geometrical tolerances of form: general considerations, tolerance indicator and tolerance feature | exposition, exemplification, discussions | 2 |
| Lecture 8 | Geometrical tolerances of form: plane and feature (auxiliary) indicators, definitions and interpretation of form tolerances | exposition, exemplification, discussions | 2 |
| Lecture 9 | Geometrical tolerances of orientation, location and runout: general consideration, tolerance indicator, tolerance feature and datum feature/s | exposition, exemplification, discussions | 2 |
| Lecture 10 | Geometrical tolerances of orientation, location and runout: defintion and interpretation | exposition, exemplification, discussions | 2 |
| Lecture 11 | Principles for tolerance requirements: principle of independency, envelope requirement and maximum material condition. General geometrical tolerances | exposition, exemplification, discussions | 2 |
| Lecture 12 | Verification during the semester (Verification 2) | evaluation, discussions | 2 |
| Lecture 13 | Surface roughness: surface profile parameters, surface texture symbols, examples of symbology applications. ISO technique for applying surface texture symbols | exposition, exemplification, discussions | 2 |
| Lecture 14 | Synthesis course | exemplification, discussions | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.b. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Measuring of geometric specifications of products using calipers: classification, reading schemes. | exemplification, simulator training | 2 |
| Laboratory 2 | Measuring of geometric specifications of products using calipers: measurement schemes. | practical demonstration, discussions | 2 |
| Laboratory 3 | Measuring of geometric specifications of products using micrometers: classification, reading schemes. | exemplification, simulator training | 2 |
| Laboratory 4 | Measuring of geometric specifications of products using micrometers: measurement schemes. | practical demonstration, discussions | 2 |
| Laboratory 5 | Gauge blocks: classification and rules to form a gauge block. Comparators: general considerations, reading schemes. | exemplification, simulator training | 2 |
| Laboratory 6 | Measuring of geometric specifications of products using mechanical comparators: measurement schemes. | practical demonstration, discussions | 2 |
| Laboratory 7 | Measuring of angles using protractors and sinus bar: general considerations, reading schemes | exemplification, simulator training | 2 |
| Laboratory 8 | Measuring of angles using protractors and sinus bar: measurement schemes. | practical demonstration, discussions | 2 |
| Laboratory 9 | Design of plain limit gauges (Go-No Go gauges for cylindrical holes and shafts) | exposition, exemplification | 2 |
| Laboratory 10 | Design of plain limit gauges (Go-No Go gauges for cylindrical holes and shafts) | applications | 2 |
| Laboratory 11 | Methods and measuring equipment to measure roughness. | exposition, exemplification, practical demonstration | 2 |

| | | | |
|---|---|---|---|
| Laboratory 12 | Measuring of dimensional and geometrical specifications using coordinate measuring machines (CMM). | exposition, exemplification, simulator training | 2 |
| Laboratory 13 | Measuring of dimensional and geometrical specifications using coordinate measuring machines (CMM). | practical demonstration, discussions | 2 |
| Laboratory 14 | Evaluation of laboratory activity | individual discussion | 2 |
| | | **Total laboratory hours:** | **28** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Oleksik, M. Ubiquitos Statistics and Probability, Teora USA LLC, Maryland, ISBN 978-1-59496-2103, 2023 |
| | Charpentier, F., Handbook for the geometrical specification of products. The ISO-GPS standards, Edit. Reseau Canope, Paris, 2016. |
| | Oleksik, M., Simion, C. Tehnici și metode de inspecție asistată de calculator - Curs și aplicații. Editura Techno Media, Sibiu, ISBN 978-606-616-504-4, 2023 |
| | Oleksik, M., Roșca, L. Analiza datelor cu Microsoft Excel, Editura Pro Universitaria, ISBN 978-606-26-1690-8, 2023 |
| | Cogorno, G., R., Geometric Dimensioning and Tolerancing for Mechanical Design, Third edition. McGraw-Hill, New York, 2020. |
| | Henzold, D., Geometrical Dimensioning and Tolerancing for Design, Manufacturing and Inspection, 3rd edition, Editura Butterworth - Heinemann ELSEVIER, UK, 2020. |
| | Raghavendra, N., V., Krishnamurthy, L., Engineering, Metrology and Measurements. University Press, Oxford, 2013. |
| | Simion, C., Toleranţe dimensionale şi geometrice. Editura Universităţii "Lucian Blaga" din Sibiu, 2001. |
| | Simion, C., Toleranţe geometrice. Principii şi metode de verificare. Editura "Alma Mater" din Sibiu, 2006. |
| | Simion, C., Purcar, C., Măsurarea specificaţiilor geometrice de produs. Editura Universităţii "Lucian Blaga" din Sibiu, 2014. |
| | *** Specific standards |
| | *** Prospects of measuring equipment |
| 9.2. Additional Bibliography | Cioată, F., Munteanu, A., Toleranțe și control dimensional. Suport de curs. Facultatea de construcții de mașini și management industrial, Iași, 2020. |
| | Crișan, L., Tripa, M., Pop, G., Control Dimensional, îndrumător pentru lucrări de laborator. Editura U.T. PRESS, 2014 |
| | Drăgan, L., Toleranțe și măsurări. Editura Risoprint, Cluj-Napoca, 2015 |
| | Itu,T.,Tripa, M., Tolerante și ajustaje. Editura U.T. PRESS, Cluj Napoca, 2008 |
| | Pascu, C., I., Toleranțe și control dimensional. ISBN: 978-606-14-1617-2, Universitatea din Craiova, Editura Universitaria, 2020. |
| | Pater, S., Toleranțe și control dimensional. Editura Universităţii din Oradea, 2017. |
| | Tero., M., Tero, M., Toleranțe și control dimensional. Editura NAPOCA STAR, Cluj-Napoca, 2015 |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | | Tests during the semester[25]: | 20% | 90% (minimum 5) | nCPE |

| | | | | | |
|---|---|---|---|---|---|
| | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Homework: | % | | |
| | | Other activities[26]: | % | | |
| | | Final evaluation: | 80% (min. 5) | | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 10% (minimum 5) | CPE |
| 11.5 Minimum performance standard[27] | | | | | 50% (after summing the weighted scores according to point 11.3) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. Prof. PhD Mihaela OLEKSIK | |
| **Study Program Coordinator** | Assoc. Prof. PhD Mihai CRENGĂNIȘ | |
| **Head of Department** | Prof. PhD Dan MIRICESCU | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*

[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Fundamentals of automated systems | | | Code | MCTEN.405.DO | |
| 2.2. Course coordinator | Prof. PhD. Radu-Eugen BREAZ | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța RUSU | | | | | |
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 4 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 30 |
| Additional learning by using library facilities, electronic databases and on-site information | 9 |
| Preparing seminars / laboratories, homework, portfolios and essays | 30 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **69** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Mathematical analysis, Numerical methods |
| 4.2. Competencies | Basic knowledge of solving differential equations |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video projector, online platforms, etc. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | MATLAB & Simulink software package |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | design automation components | 0.7 |
| | PC2 | simulate mechatronic design concepts | 0.7 |
| | PC3 | execute analytical mathematical calculations | 0.7 |
| | PC4 | analyse test data | 0.7 |
| | PC5 | develop mechatronic test procedures | 0.7 |
| | PC6 | think abstractly | 0.7 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0.3 |
| | TC2 | create solutions to problems | 0.3 |
| | TC3 | manage personal professional development | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring theoretical and practical knowledge in the field of control systems |
| 7.2. Specific course objectives | It is anticipated that after studying this discipline, the students will be able to:<br>• Define the basic concepts within control systems theory;<br>• Identify the relationships between the control systems and their structure;<br>• Build the mathematical model of a control systems based upon differential equations and transfer functions. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Control systems terminology. Block diagrams. Closed loops systems block diagram. National and international standards regarding the specific terminology. | Heuristic conversation<br>Explanation<br>Case study | 2 |
| Lecture 2 | Classification of control systems. Continuous and discrete systems. Linear and nonlinear systems. Deterministic and random systems. Stationary and non-stationary systems. Modeling automatic systems based on linear differential equations with constant coefficients. | - ” - | 2 |
| Lecture 3 | Types of signals used in control systems. Unit step, unit ramp and unit impulse signals. Laplace transform and its inverse. Transfer functions. | - ” - | 2 |
| Lecture 4 | Algebra of functional schemes with transfer functions. Series, parallel and feedback connections. Complex schemes. Simplification of complex functional schemes. Calculation of the equivalent transfer function. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Simple element analysis. Ideal elements P, I, D. First order and second order delay elements. Examples of real systems encountered in engineering with behaviors similar to those studied. | - ” - | 2 |
| Lecture 6 | Performance of continuous linear systems. Performance indices defined on the basis of the step response. | - ” - | 2 |
| Lecture 7 | Stability of control systems. Stability criteria. Complex plane stability criterion. Routh-Hurwitz stability criterion. | - ” - | 2 |
| Lecture 8 | PID-type automatic controllers. Tuning of controllers. Case study for DC motor using angular speed as output signal. | - ” - | 2 |
| Lecture 9 | Root locus method. Root locus plotting rules. | - ” - | 2 |
| Lecture 10 | Applications of the root locus method for DC motor using angular speed as an output signal. Advance and phase delay compensation elements. | - ” - | 2 |
| Lecture 11 | Modeling a system in state space. | - ” - | 2 |
| Lecture 12 | Computational techniques using state variables. | - ” - | 2 |
| Lecture 13 | Motion control systems. Specific features of position and velocity control systems. Generation of reference input quantities. Applications in mechatronics and robotics. | - ” - | 2 |
| Lecture 14 | Overview of advanced automatic control techniques. Fuzzy controllers. Artificial neural networks. Adaptive neuro-fuzzy systems. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Matlab & Simulink software environment presentation | Heuristic conversation Demonstration Experiment | 2 |
| Laboratory 2 | Definition of continuous variable transfer functions in the Matlab environment - Control System Toolbox. Study of the functional algebra of control systems. Syntax of specific commands - part I. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 3 | Definition of continuous variable transfer functions in the Matlab environment - Control System Toolbox. Study of the functional algebra of control systems. Syntax of specific commands - part II. | - ” - | 2 |
| Laboratory 4 | Analysis of simple elements in Matlab - Control System Toolbox. | - ” - | 2 |
| Laboratory 5 | Performance study of continuous linear systems using the Matlab - Control System Toolbox environment. | - ” - | 2 |
| Laboratory 6 | Study the stability of automatic systems using the Control System Toolbox in the Matlab - Control System Toolbox environment. Syntax of specific commands. | - ” - | 2 |
| Laboratory 7 | Root locus method, implementation in Matlab - Control System Toolbox. Syntax of specific commands. | - ” - | 2 |
| Laboratory 8 | Study the behavior of control systems by dynamic simulation using Simulink environment. Simulink standard libraries - Part I. | - ” - | 2 |
| Laboratory 9 | Study the behavior of control systems by dynamic simulation using Simulink environment. Simulink standard libraries - Part II. | - ” - | 2 |
| Laboratory 10 | Tuning PID controllers using the Control System Designer interactive interface. | - ” - | 2 |
| Laboratory 11 | Mathematical modeling and dynamic simulation of complex motion control systems using Matlab & Simulink environment. | - ” - | 2 |
| Laboratory 12 | Motion control systems using DC servomotors as actuator. | - ” - | 2 |
| Laboratory 13 | Mathematical modeling and dynamic simulation of electro-hydraulic servo systems. | - ” - | 2 |
| Laboratory 14 | Definition of automatic control systems by state equations in Matlab - Control System Toolbox. | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |

| | | | |
|---|---|---|---|
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Breaz, R., *Fundamentals of automated systems - course* (digital format) |
| | Breaz, R.E., Tera, M., *Teoria sistemelor și reglaj automat - aplicații,* Editura Universității "Lucian Blaga" din Sibiu, 2010 |
| | Bîrsan, I., Breaz, R., *Ingineria sistemelor hidraulice automate*, Editura Universității "Lucian Blaga" din Sibiu, 2003 |
| 9.2. Additional Bibliography | Leonard, W., *Control of Electric Drives*, Springer Verlag, Berlin, 1985 |
| | Weck, M., Werkzeugmaschinen, *Band 3, Automatisierung und Steuerungtechnik*, VDI Verlag, Düsseldorf, 1989 |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 70% (minimum 5) | Written questionnaire |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | justification of the chosen solutions | | | |
| 11.5 Minimum performance standard[29]<br>• Knowledge about the basic principles of control systems theory;<br>• Ability to calculate continuous and discrete transfer functions for simple block diagrams;<br>• Knowledge regarding the transfer functions of ideal elements;<br>• Knowledge about stability criteria of continuous control systems;<br>• Knowledge about the main types of controllers and their tuning criteria;<br>• Ability to perform analysis and synthesis of simple control systems;<br>• Ability to determine the response of the systems using MATLAB software package. | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Prof. PhD. Radu-Eugen Breaz | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | **Faculty of Engineering** |
| 1.3. Department | **Department of Machines and Industrial Equipment** |
| 1.4. Field of study | **Mechatronics and Robotics** |
| 1.5. Level of study[1] | **Bachelor** |
| 1.6. Programme of study/qualification | **MECHATRONICS** |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | **Fluid Mechanics** | | | | Code | MCTEN.406.DO |
| 2.2. Course coordinator | **Assoc. prof. PhD Claudiu ISARIE** | | | | | |
| 2.3. Seminar/laboratory coordinator | **Assoc. prof. PhD Claudiu ISARIE** | | | | | |
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 4 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 7 |
| Preparing seminars / laboratories, homework, portfolios and essays | 5 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | N/A |
| 4.2. Competencies | Computer operating knowledge,<br>Basic knowledge of Mechanics,<br>Mathematical analysis-integral and differential calculus |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Board, video projector, online platforms,<br>Active participation |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Board, video projector, specific teaching materials, online platforms,<br>Active participation |

**6. Specific competencies acquired[17]**

| | | | Număr de credite alocat disciplinei[18] 3 | Repartizare credite pe competențe[19] |
|---|---|---|---|---|
| **6.1. Competențe profesionale** | CP1 | analyse test data | | 0,5 |
| | CP2 | approve engineering design | | 0,5 |
| | CP3 | conduct quality control analysis | | 0,25 |
| | CP4 | perform test run; | | 0,25 |
| | CP5 | keep up with digital transformation of industrial processes; | | 0,25 |
| | CP6 | use CAD software; | | 0,25 |
| **6.2. Competențe transversale** | CT1 | manage personal professional development | | 0,25 |
| | CT2 | think abstractly | | 0,25 |
| | CT3 | speak different languages | | 0,5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The course consists of lectures and practical exercises. While the basic concepts of statics and the dynamics of fluids are introduced in the course of the lectures, the exercise is devoted to methodological aspects for solving technical problems of fluid dynamics. |
| 7.2. Specific course objectives | Develop an appreciation for the properties of fluids,<br>Understand the dynamics of fluid flows and the governing equations,<br>Apply concepts of mass, and energy conservation to flows. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | The importance of studying fluid mechanics. Applications in various fields. | Heuristic conversation, explanation. | 2 |
| Lecture 2 | Properties of fluids. Properties common to liquids and gases. | - ” - | 2 |
| Lecture 3 | Specific properties of liquids. Specific properties of gases | - ” - | 2 |
| Lecture 4 | Fluid statics. Euler equations of static. The fundamental equation of static. | - ” - | 2 |
| Lecture 5 | The action of fluids on solid surfaces. | - ” - | 2 |
| Lecture 6 | Fluid kinematics. Methods of study. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 7 | Fundamentals in fluid kinematics. Classification of movements. Reynolds' experience. | - ” - | 2 |
| Lecture 8 | The continuity equation. | - ” - | 2 |
| Lecture 9 | Dynamics of ideal fluids. | - ” - | 2 |
| Lecture 10 | Bernoulli's equation. | - ” - | 2 |
| Lecture 11 | Technical applications of Bernoulli's equation | - ” - | 2 |
| Lecture 12 | Impulse theorem. | - ” - | 2 |
| Lecture 13 | Hydrodynamic forces. | - ” - | 2 |
| Lecture 14 | Hydropower. Environment-friendly and renewable energy sources. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

| **8.2.a. Practical activities** Laboratory[22] | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Lab. 1 | Work safety norms in the laboratory. Introduction. Measurement process accuracy. | Theoretical study / Practical applications | 2 |
| Lab. 2 | Fluid properties. Density measurement | - ” - | 2 |
| Lab. 3 | Bourdon tube used for the measurement of gauge pressure | - ” - | 2 |
| Lab. 4 | Viscosity measurement and the principles of viscosity | - ” - | 2 |
| Lab. 5 | Measurement of fluid-flow-velocity profile | - ” - | 2 |
| Lab. 6 | Pelton Turbine Demonstrator | - ” - | 2 |
| Lab. 7 | Synthesis and evaluation | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | 1. Bosioc A. I., *Mecanica fluidelor si masini hidraulice. Suport de curs si aplicatii de calcul*, Editura Politehnica, 118 pag., 2017, ISBN:9786063501838. |
| | 2. Isarie, C., *Mecanica fluidelor*, Editura Universităţii "Lucian Blaga" din Sibiu, re-ed 2014; |
| | 3. Philip j. Pritchard *Introduction to Fluid Mechanics*, Eighth edition 2011, ISBN-13 9780470547557 |
| | 4. Panaitescu, V., Tcacenco, V., *Bazele mecanicii fluidelor*, Editura Tehnică, Bucureşti 2001. |
| 9.2. Additional Bibliography | 1. Racz, G., Girjob C. *Sisteme hidraulice de actionare*, Editura Universităţii "Lucian Blaga" din Sibiu, 2017. |
| | 2. Anton, L., Balint, D., Baya, A., *Mecanica fluidelor, masini hidraulice si actionari. Aplicatii de calcul* . Editura Orizonturi Universitare , Timisoara, 2004, ISBN: 9736380769 |
| | 3. Parr A., *Hydraulics and Pneumatics: A Technician's and Engineer's Guide*, Elsevier Ltd., 2011, ISBN 978-0-08-096674-8, https://doi.org/10.1016/C2009-0-64113-1. |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[24]

Design and implementation of activities, research projects in order to apply skills acquired in the studied discipline.
The content of the discipline is in accordance with what is presented in other university centers in the country and abroad.
It is carried out through regular discussions in a formal and informal setting with the representatives of engineering profile companies.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[25] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired | Tests during the semester[26]: | 30 % | 70 % (minimum 5) | CPE |
| | | Homework: | 5 % | | |

| | | | | | |
|---|---|---|---|---|---|
| | (quantity, correctness, accuracy) | Other activities[27]: | 5 % | | |
| | | Final evaluation: | 60 % | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | - | N/A |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30 % (minimum 5) | CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | - | N/A |
| 11.5 Minimum performance standard[28] | | | | | 50 % (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: | 1 | 6 | / | 0 | 9 | / | 2 | 0 | 2 | 4 |

Department Acceptance Date: | 3 | 0 | / | 0 | 9 | / | 2 | 0 | 2 | 4 |

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | **Assoc. prof. PhD Claudiu ISARIE** | |
| **Study Program Coordinator** | **Assoc. prof. PhD Mihai CRENGANIS** | |
| **Head of Department** | **Assoc. prof. PhD Claudia GÎRJOB** | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *Din planul de învățământ*
[19] *Creditele alocate disciplinei se distribuie pe competențe profesionale și transversale în funcție de specificul disciplinei*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[24] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[25] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[26] *The number of tests and the weeks in which they will be taken will be specified*
[27] *Scientific circles, professional competitions, etc.*
[28] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024- 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | Computer-aided design | | Code | MCTEN.502.DO | |
| 2.2. Course coordinator | Associate professor PhD. Cristina Maria BIRIȘ | | | | |
| 2.3. Seminar/laboratory coordinator | Associate professor PhD. Cristina Maria BIRIȘ | | | | |
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 1 | 0 | **5** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 14 | 0 | **70** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 15 |
| Preparing seminars / laboratories, homework, portfolios and essays | 20 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*** | **55** |
| **3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*** | **70** |
| **3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge of technical drawing and descriptive geometry |
| 4.2. Competencies | Computer skills (minimum Office, Internet browser) |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation<br>Lecturing the course |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Writing and presenting planned papers<br>Active participation<br>Reading the recommended bibliography |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | adjust engineering designs | 1 |
| | PC2 | approve engineering design | 1 |
| | PC3 | design prototypes | 1 |
| | PC4 | use technical drawing software | 2 |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | | |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge of and understanding concepts, theories and basic methods of computer-aided design |
| 7.2. Specific course objectives | It is anticipated that by the end of the course, the students will be able to:<br>- use the methods and techniques of computer-aided design;<br>- computer-aided design three-dimensional models of medium complexity;<br>- respect personal characteristics. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | The challenges of computer-aided design: strategies, methods, stages.<br>Software packages used in the computer-aided design of mechanical systems. | Lecturing supported by using modern methods of image projection. | 2 |
| Lecture 2 | Describing and developing design algorithms. 2D and 3D graphic representations. 3D design principles. | - ” - | 2 |
| Lecture 3 | Describing and developing design algorithms. 2D and 3D graphic representations. 3D design principles. | - ” - | 2 |
| Lecture 4 | Computer-aided design using CATIA: designing and creating parts | - ” - | 2 |
| Lecture 5 | Computer-aided design using CATIA: designing and creating parts | - ” - | 2 |
| Lecture 6 | Computer-aided design using CATIA: designing and creating parts | - ” - | 2 |
| Lecture 7 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 8 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 9 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 10 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 11 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 12 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 13 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| Lecture 14 | Computer-aided design using CATIA: designing and creating assemblies | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.b. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | CATIA software package: presentation, types of files, file management, identifying the menus and the command buttons in CATIA | Heuristic methods | 2 |
| Laboratory 2 | 3D part modelling | - ” - | 2 |
| Laboratory 3 | 3D part modelling | - ” - | 2 |
| Laboratory 4 | 3D part modelling | - ” - | 2 |
| Laboratory 5 | Strategies of making 3D assemblies | - ” - | 2 |
| Laboratory 6 | Strategies of making 3D assemblies | - ” - | 2 |
| Laboratory 7 | 3D part modelling | - ” - | 2 |
| Laboratory 8 | 3D part modelling | - ” - | 2 |
| Laboratory 9 | 3D part modelling | - ” - | 2 |
| Laboratory 10 | 3D part modelling | - ” - | 2 |
| Laboratory 11 | 3D part modelling | - ” - | 2 |
| Laboratory 12 | Parameterizing 3D models, parts and assemblies | - ” - | 2 |
| Laboratory 13 | Parameterizing 3D models, parts and assemblies | - ” - | 2 |
| Laboratory 14 | Parameterizing 3D models, parts and assemblies | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Project 1 | Defining the topic. Making an assembly of minimum 15 parts with medium complexity. | Heuristic methods | 2 |
| Project 2 | 3D part modelling | - ” - | 2 |
| Project 3 | 3D part modelling | - ” - | 2 |
| Project 4 | 3D part modelling | - ” - | 2 |
| Project 5 | 3D modelling of the assembly | - ” - | 2 |
| Project 6 | 3D modelling of the assembly | - ” - | 2 |
| Project 7 | Project presentation | - ” - | 2 |
| | | **Total project hours:** | **14** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Racz, G., Proiectarea asistată de calculator utilizând CATIA v5, note de curs, 2010 |
| | Ghionea, I.G., Proiectarea asistată în CATIA v5. Elemente teoretice şi aplicaţii, Editura Bren, Bucureşti, 2007. |
| | * * *, Catia v5 – courses offered by company, Dassault Systemes, 2017-2021 |
| | Weck, M., Werkzeugmaschinen, Band 1 – 4, VDI Verlag, Düsseldorf, 1989. |
| 9.2. Additional Bibliography | Moraru, V., Teoria şi proiectarea maşinilor-unelte, EDP, Bucureşti, 1985. |
| | Racz, G., Proiectarea maşinilor şi utilajelor, Editura Universităţii „Lucian Blaga" din Sibiu, 2007. |
| | Moraru, V., Teoria şi proiectarea maşinilor-unelte, EDP, Bucureşti, 1985. |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[24]

Developing efficient instruments of knowledge of personality.
Designing and implementing activities and research projects in order to apply the competencies acquired throughout the course.
Elaborating strategies of improving the cognitive functions in the input, elaboration and output.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[25] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[26]: | 0% | 60% (minimum 5) | Oral exam |
| | | Homework: | 0% | | |
| | | Other activities[27]: | 0% | | |
| | | Final evaluation: | 100% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 10% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 30% (minimum 5) | |
| 11.5 Minimum performance standard[28] | | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Associate professor PhD. Eng. Cristina Maria BIRIȘ | |
| **Study Program Coordinator** | Associate professor PhD. Eng. Mihai CRENGANIȘ | |
| **Head of Department** | Associate professor PhD. Eng. Claudia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *Case study, demonstration, exercise, error analysis, etc.*
[24] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[25] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[26] *The number of tests and the weeks in which they will be taken will be specified*
[27] *Scientific circles, professional competitions, etc.*
[28] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Fundamentals of robotics | Code | MCTEN.503.DO |
| 2.2. Course coordinator | Assoc. prof. dr. ing. Mihai CRENGANIȘ | | |
| 2.3. Seminar/laboratory coordinator | Asist. drd. ing. Timotei Morariu | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | III | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **69** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Fundamentals of mechatronic systems, electronics, fundamentals of automatic systems |
| 4.2. Competencies | Knowledge of industrial drives, basis of automatic systems, basis of mechatronic systems, computer-aided design |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and applied presentations, Reading recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Preparation and defense of planned work. Active participation, Reading recommended bibliography |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | simulates mechatronic design concepts | 1 |
| | PC2 | develop mechatronic test procedures | 0.5 |
| | PC3 | describes the electrical drive system | 0.5 |
| | PC4 | tests mechatronic units | 0.5 |
| | PC5 | designs prototypes | 0.5 |
| | PC6 | designs automation components | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesizes information | 0.5 |
| | TC2 | finds solutions to problems | 0.5 |
| | TC3 | thinks abstractly | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Familiarizing students with the fundamental concepts of robotics, including terminology, classification, structure, and operating principles of industrial and mobile robots, and developing the basic skills necessary to understand and apply concepts of kinematics, dynamics, and control for various types of robots. |
| 7.2. Specific course objectives | Acquisition of terminology and fundamental concepts in robotics<br>Classification and analysis of types of robots and industrial manipulators<br>Understanding the mechanical structures and configurations of robots<br>Application of forward and inverse kinematics concepts for serial robots<br>Workspace analysis and its correspondence with kinematic structure<br>Exploration of actuation and control elements in robotics<br>Development of basic notions of motion control for robots<br>Study and application of kinematics for parallel and mobile robots<br>Understanding and application of navigation for mobile robots<br>Integration of robots into flexible manufacturing cells and systems<br>Completion of a final project on modeling an industrial robot |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Concepts regarding Industrial Robotics (IR), terminology | The classic lecture (synthetic presentation, explanations, demonstration through diagrams, graphs) | 2 |

| | | | |
|---|---|---|---|
| | | supported by the use of image projection tools / problem-based learning, learning through discovery, experiment, and case study. | |
| Lecture 2 | Industrial robots: definition, classification, specific elements | - ” - | 2 |
| Lecture 3 | Industrial robots: definition, classification, specific elements | - ” - | 2 |
| Lecture 4 | Workspaces; structure, kinematics, dynamics. Correspondence between workspace, structure, kinematics, and dynamics | - ” - | 2 |
| Lecture 5 | Workspaces; structure, kinematics, dynamics. Correspondence between workspace, structure, kinematics, and dynamics | - ” - | 2 |
| Lecture 6 | Elements of actuation and control for industrial robots/manipulators | - ” - | 2 |
| Lecture 7 | Elements of actuation and control for industrial robots/manipulators | - ” - | 2 |
| Lecture 8 | Serial robots: Structure | - ” - | 2 |
| Lecture 9 | Serial robots: Coordinate systems | - ” - | 2 |
| Lecture 10 | Parallel robots. Mobile robots | - ” - | 2 |
| Lecture 11 | Mobile robots. AGVs | - ” - | 2 |
| Lecture 12 | Industrial robots/manipulators integrated into flexible cells and flexible production systems | - ” - | 2 |
| Lecture 13 | Industrial robots/manipulators integrated into flexible cells and flexible production systems | - ” - | 2 |
| Lecture 14 | Aspects regarding the implementation conditions of inter-operational transfer systems in Flexible Production Systems (FPS) | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Work protection instructions, laboratory presentation, and topics, automation concept | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Automation concept | - ” - | 2 |
| Laboratory 3 | Robots. Industrial robots - Structure | - ” - | 2 |
| Laboratory 4 | IR/M in Cartesian coordinates. Structure, kinematics, actuation. | - ” - | 2 |
| Laboratory 5 | IR/M in Cylindrical coordinates. Structure, kinematics, actuation. | - ” - | 2 |
| Laboratory 6 | IR in Spherical coordinates. Structure, kinematics, actuation. | - ” - | 2 |
| Laboratory 7 | IR in angular coordinates. Structure, kinematics, actuation. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 8 | Study of a KUKA robot used in inter-operational transfer | - ” - | 2 |
| Laboratory 9 | Programming the KUKA robot | - ” - | 2 |
| Laboratory 10 | Specialized robots: Automatic tool changing | - ” - | 2 |
| Laboratory 11 | Aspects regarding the implementation of industrial robots | - ” - | 2 |
| Laboratory 12 | Flexible cell (CF) for transferring leaf springs | - ” - | 2 |
| Laboratory 13 | Interoperational transfer subsystems, Study of the supply/evacuation system in the robotic assembly CF | - ” - | 2 |
| Laboratory 14 | Synthesis of laboratory activity and make-up sessions | - ” - | 2 |
| | | **Total laboratory hours:** | 28 |

| **8.2.c. Project** | **Teaching methods[24]** | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Telea, D., Roboti, Ed. Dacia Cluj-Napoca, 2001 |
| | Telea, D., Mașini, echipamente si strategii in SFP, Ed. Univ.L Blaga, 2009 |
| | Telea, D., Bazele roboticii Ed.Univ.L Blaga, Sibiu, 2010 |
| | Telea, D. & Crenganis M. Roboti industriali. Ed.Univ.L Blaga, Sibiu, 2016 |
| | Chicea A. & Crenganis M. Bazele sistemelor mecatronice, Ed.Univ.L Blaga, Sibiu, 2017 |
| | Crenganis M. & Chicea A. Mecatronica roboților si manipulatoarelor industriale Ed.Univ.L Blaga, Sibiu, 2018 |
| | Giurgiutiu V., Lyshevski S.E., *Micromechatronics*, CRC Press, Inc.2004, ISBN: 0-8493-1593 |
| | Mogan G.L., Proiectarea constructivă a sistemelor mecanice ale produselor mecatronice, Ed. Univ. Transilvania, Braşov, 2003 |
| | Taraboanta F. - Mecatronica generala, Ed. Gh. Asachi, Iasi, 2002 |
| | Bishop H. Robert, *The Mechatronics Handbook*, CRC Press, London-New York-Washington, 2002 |
| | |
| | |
| | |
| 9.2. Additional Bibliography | Crenganis M. & Chicea A. Redundanta roboților seriali si industriali Ed.Univ.L Blaga, Sibiu, 2020 |
| | Fu K. S., Gonzalez R. C., Lee C. S. G., Robotics, Mc Graw-Hill, 1987. |
| | Ivănescu M., Roboţi industriali, Edit. Universitaria, Craiova, 1994. |
| | |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through periodic discussions in formal and informal settings with representatives of specialized companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 30% | 70% (minimum 5) | Oral |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | Grade 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. prof. PhD Mihai Crenganis | |
| **Study Program Coordinator** | Assoc. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Hydronics and Pneutronics 1 | Code | MCTEN.504.SO |
| 2.2. Course coordinator | PhD. Prof. Eng. Eugen AVRIGEAN | | |
| 2.3. Seminar/laboratory coordinator | PhD student. Asst. Eng. Fineas MORARIU | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 28 |
| Additional learning by using library facilities, electronic databases and on-site information | 21 |
| Preparing seminars / laboratories, homework, portfolios and essays | 20 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **69** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge of mechanics, strength of materials, machine parts, mechanisms, fluid mechanics |
| 4.2. Competencies | Computer skills (minimum Office, Internet browser) |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation<br>Lecturing the course |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Reading the recommended bibliography<br>Writing and presenting planned papers<br>Active participation |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | test mechatronic units | 1 |
| | PC2 | examine engineering principles; | 1 |
| | PC3 | maintain control systems for automated equipment; | 1 |
| | PC4 | create technical plans; | 1 |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | apply blended learning. | 1 |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge of and understanding concepts, theories and basic methods of projecting hydraulic actioning and commanding systems of machine-tools and production systems; |
| 7.2. Specific course objectives | It is anticipated that by the end of the course, the students will be able to:<br>- design and implement drivelines of medium and high complexity;<br>- action, operate and maintain machine-tools and production systems;<br>- respect personal characteristics. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introductory concepts, laws and basic formulas used in hydraulics. Types of hydraulic fluids | Lecturing supported by using modern methods of image projection. | 2 |
| Lecture 2 | Energy convertors. Hydraulic generators | - ” - | 2 |
| Lecture 3 | Energy convertors. Hydraulic generators | - ” - | 2 |
| Lecture 4 | Energy convertors. Hydraulic generators | - ” - | 2 |
| Lecture 5 | Energy convertors. Hydraulic engines | - ” - | 2 |
| Lecture 6 | Energy convertors. Hydraulic engines | - ” - | 2 |
| Lecture 7 | Command and control of hydraulic generators and engines | - ” - | 2 |
| Lecture 8 | Hydraulic speed variators | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 9 | Relief valves | - ” - | 2 |
| Lecture 10 | Pressure control and command device | - ” - | 2 |
| Lecture 11 | Flow control and command device | - ” - | 2 |
| Lecture 12 | Pipes, blocks and modular constructions for transporting hydraulic energy<br>Hydraulic tanks, filters and hydraulic accumulators<br>Sealing and systems of sealing | - ” - | 2 |
| Lecture 13 | Choosing and coding hydraulic apparatus used in cars and machines | - ” - | 2 |
| Lecture 14 | Analysis of the functioning of a hydraulic actioning system | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Workplace safety rules. Presenting units of measurement. The study of STAS with reference to: terminology, symbolizing and representing hydraulic systems | Heuristic methods | 2 |
| Laboratory 2 | The study of constructively and functionally designing generators and rotary and linear hydraulic and pneumatic engines | - ” - | 2 |
| Laboratory 3 | The study of constructively and functionally designing the distribution apparatus. Coding | - ” - | 2 |
| Laboratory 4 | The study of constructively and functionally designing the pressure command and control apparatus. Coding | - ” - | 2 |
| Laboratory 5 | The study of constructively and functionally designing the debit command and control apparatus. Coding | - ” - | 2 |
| Laboratory 6 | The study of hydraulic circuits for making custom functional cycles | - ” - | 2 |
| Laboratory 7 | The study of hydraulic circuits for making custom functional cycles | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 8 | Constructive research of designing hydraulic panels | - ” - | 2 |
| Laboratory 9 | Constructive research of designing hydraulic panels | - ” - | 2 |
| Laboratory 10 | Constructive research of designing hydraulic panels | - ” - | 2 |
| Laboratory 11 | Constructive research of designing hydraulic panels | - ” - | 2 |
| Laboratory 12 | Specialized software in analysis and synthesis of hydraulic installations | - ” - | 2 |
| Laboratory 13 | Specialized software in analysis and synthesis of hydraulic installations | - ” - | 2 |
| Laboratory 14 | Specialized software in analysis and synthesis of hydraulic installations | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Racz, S., G., Girjob, C., E., Biris, C., M., Sisteme hidraulice de actionare : Indrumar de laborator Editura Universitatii "Lucian Blaga", Sibiu, 2016. |
| | Bârsan, I., Racz, S., G., Actionari hidraulice si pneumatice : Aplicatii, Editura Universitatii "Lucian Blaga", Sibiu, 2003. |
| | Racz, S., G., Girjob, C., E., Sisteme hidraulice de actionare : Pentru uzul studentilor, Editura Universitatii "Lucian Blaga", Sibiu, 2016. |

| | |
|---|---|
| | Bârsan, I., Popp, I., Bogdan, L., Telea, D., Fetche, V. - Acţionări şi automatizări hidraulice. Elemente de proiectare, Editura Universitatii "Lucian Blaga", Sibiu, 1996. |
| | Tero, M., Actionari hidraulice si pneumatice: Pentru uzul studentilor, Editura Universității „Petru Maior”, Târgu Mureș, 2013. |
| | David, I., Ștefănescu, C., Hidraulică: teme aplicative, Editura Politehnica, Timișoara, 2013. |
| | Pădurean, I., Hidraulică și sisteme de acționare: compendium, Editura Eurostampa, Timișoara, 2012. |
| | Bordeașu, I., Păcurar, C., Bordeașu, D., Hidraulică: noțiuni teoretice și probleme de hidrostatică, Editura Politehnica, Timișoara, 2017. |
| | Axinti, A.S., Șcheaua, F.D., Introducere în hidraulica industrială, Editura Galați University Press, Galați, 2015 |
| | |
| 9.2. Additional Bibliography | Ispas, V., ş.a. - Roboţi industriali, Ed. Didactică Cluj Napoca '85. |
| | Ionescu, Fl. - Mecanica fluidelor şi acţionari hidraulice şi pneumatice, Ed. Didactică şi pedagogică Bucureşti '80. |
| | Ivan, M., Maniut, P., Cristian, I., Dobre, G. - Hidraulica maşinilor unelte, Ed. Universitatea Braşov '89. |
| | * https://www.lunchboxsessions.com/ |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through regular discussions in formal and informal meetings with the representatives of profile companies

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 50% (minimum 5) | Written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 50% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the | • Self-evaluation, project presentation | | 0% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | project documentation, the appropriate justification of the chosen solutions | • Critical evaluation of a project | | |
| 11.5 Minimum performance standard[29] | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | PhD. Prof. Eng. Eugen AVRIGEAN | |
| **Study Program Coordinator** | PhD. Lect. Eng. Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Constructive elements of mechatronics | Code | MCTEN.505.SA |
| 2.2. Course coordinator | Lecturer PhD. Mihai-Octavian POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Mihai-Octavian POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | General knowledge of technical drawing, mechanics, material fatigue, machine parts. |
| 4.2. Competencies | Computer skills (minimum: Word, Internet Explorer). |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Active participation<br>• Reading the course material |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Reading the recommended bibliography<br>• Elaboration and support of planned practical works<br>• Active participation |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | 4 |
| **6.1. Professional competencies** | PC1 | Develop mechatronic test procedures | 0.5 |
| | PC2 | Execute analytical mathematical calculations | 0.5 |
| | PC3 | Think abstractly | 0.5 |
| | PC4 | Design prototypes | 0.5 |
| | PC5 | Simulate mechatronic design concepts | 0.5 |
| | PC6 | Test mechatronic units | 0.5 |
| **6.2. Transversal competencies** | TC1 | Synthesise information | 0.5 |
| | TC2 | Create solutions to problems | 0.5 |

Credits distribution by competencies[19]

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The aim of the discipline is for students to acquire knowledge about the kinematics and dynamics of the mechanical elements that make up the mechatronic systems. |
| 7.2. Specific course objectives | The deepening and understanding by the students of the way of operation of the existing mechanical elements, following that on the basis of this knowledge they can carry out the synthesis stage of the mechanical systems proposed to be made. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Mechatronic systems. Elements of mechatronics | The classical lecture, assisted by the use of modern means of projecting images | 2 |
| Lecture 2 | The structure of mechatronic systems. Kinematic elements, kinematic couplings used in mechatronics. | -””- | 2 |
| Lecture 3 | The structure of mechatronic systems. Kinematic chains, mechanisms. | -””- | 2 |
| Lecture 4 | Kinematic analysis of mechatronic systems. | -””- | 2 |
| Lecture 5 | Kinematic analysis of mechatronic systems. | -””- | 2 |
| Lecture 6 | Kinematic analysis methods. The matrix method. | -””- | 2 |
| Lecture 7 | Kinematic analysis. Vector contour method | -””- | 2 |
| Lecture 8 | Kinematic analysis of spatial systems. Cam mechanisms, elements of calculation and design. | -””- | 2 |
| Lecture 9 | Mechatronic systems with gears (planetary and differential mechanism). | -””- | 2 |

| | | | |
|---|---|---|---|
| Lecture 10 | Mechatronic systems with gears (planetary and differential mechanism). | -””- | 2 |
| Lecture 11 | Mechatronic systems with gears (planetary and differential mechanism). | -””- | 2 |
| Lecture 12 | Dynamics of mechatronic systems specific to mechatronics. | -””- | 2 |
| Lecture 13 | Dynamics of mechatronic systems specific to mechatronics. | -””- | 2 |
| Lecture 14 | Dynamics of mechatronic systems specific to mechatronics. | -””- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Laboratory presentation. Labor protection | Case studies, assisted by the use of modern means of projecting images | 2 |
| Laboratory 2 | The structure of mechatronic systems. | -””- | 2 |
| Laboratory 3 | Analysis and synthesis of mechatronic systems. | -””- | 2 |
| Laboratory 4 | Geared Mechatronic Systems. | -””- | 2 |
| Laboratory 5 | Actuators for translational motion. | -””- | 2 |
| Laboratory 6 | Actuators for translational motion. | -””- | 2 |
| Laboratory 7 | Actuators for rotary motion. | -””- | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**


| | |
|---|---|
| 9.1. Recommended Bibliography | V. Maties, Mecatronica, Editura Dacia Cluj-Napoca 1998 |
| | Barbu. St., Mecanisme specifice mecanicii fine, Ed. Universității Lucian Blaga Sibiu, 2013 |
| | Barbu. St., Structuri mecanice performante în mecatronică, Ed. Universității Lucian Blaga Sibiu, 2013 |
| | Handra-Luca V., Introducere în teoria mecanismelor, Editura DACIA, 1982 |
| | Dudita F., Transmisii cardanice, Editura Transilvania Expres Brașov, 2003 |
| 9.2. Additional Bibliography | Razmerita Gh., Mecanisme și dinamica mașinilor, Galați, 1998 |
| | Demian T.s.a., Mecanisme de mecanică fină, Ed. Didactica și Pedagogică, București, 1982 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| It is carried out through periodic discussions in a formal and informal setting with the representatives of the relevant companies |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 80% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 20% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Mechanical structure for mechatronics | Code | MCTEN.506.SA |
| 2.2. Course coordinator | Lecturer PhD. eng. Mihai-Octavian POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. eng. Mihai-Octavian POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | General knowledge of technical drawing, mechanics, material fatigue, machine parts. |
| 4.2. Competencies | Computer skills (minimum: Word, Internet Explorer). |

**5. Conditions** (where applicable)

| | | |
|---|---|---|
| 5.1. For course/lectures[15] | • Active participation<br>• Reading the course material | |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Reading the recommended bibliography<br>• Elaboration and support of planned practical works<br>• Active participation | |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 4 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Develop mechatronic test procedures | 0.5 |
| | PC2 | Execute analytical mathematical calculations | 0.5 |
| | PC3 | Think abstractly | 0.5 |
| | PC4 | Design prototypes | 0.5 |
| | PC5 | Simulate mechatronic design concepts | 0.5 |
| | PC6 | Test mechatronic units | 0.5 |
| **6.2. Transversal competencies** | TC1 | Synthesise information | 0.5 |
| | TC2 | Create solutions to problems | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The aim of the discipline is to develop the capacity for a theoretical and experimental approach in the activity of designing and making mechatronic systems. |
| 7.2. Specific course objectives | Knowledge of the kinematics and management of the components that make up the highly technical systems and familiarity with the main computer research and data processing software packages. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Mechatronics, mechatronic systems, operating laws of mechatronic systems. | The classical lecture, assisted by the use of modern means of projecting images | 2 |
| Lecture 2 | Mechatronics, mechatronic systems, operating laws of mechatronic systems. | -""- | 2 |
| Lecture 3 | Modeling of mechatronic systems. Mathematical modeling, physical modeling. | -""- | 2 |
| Lecture 4 | Modeling of mechatronic systems. Mathematical modeling, physical modeling. | -""- | 2 |
| Lecture 5 | Actuators used in the construction of mechatronic systems. Types of actuators. | -""- | 2 |
| Lecture 6 | Actuators used in the construction of mechatronic systems. Types of actuators. | -""- | 2 |
| Lecture 7 | Components for supporting and transmitting translational, rotational and rototranslational motion. | -""- | 2 |

| | | | |
|---|---|---|---|
| Lecture 8 | Components for supporting and transmitting translational, rotational and rototranslational motion. | -””- | 2 |
| Lecture 9 | Connection and coupling components specific to mechatronic systems. | -””- | 2 |
| Lecture 10 | Connection and coupling components specific to mechatronic systems. | -””- | 2 |
| Lecture 11 | Geared motion transmission systems. | -””- | 2 |
| Lecture 12 | Geared motion transmission systems. | -””- | 2 |
| Lecture 13 | High precision driving, displacement and positioning systems. | -””- | 2 |
| Lecture 14 | High precision driving, displacement and positioning systems. | -””- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Laboratory presentation. Way of carrying out the works. Experimental data processing. | Case studies, assisted by the use of modern means of projecting images | 2 |
| Laboratory 2 | Mechatronic systems. Motion and control components. | -””- | 2 |
| Laboratory 3 | Electric, hydraulic, pneumatic, special actuators. | -””- | 2 |
| Laboratory 4 | Connection and coupling systems. | -””- | 2 |
| Laboratory 5 | Linear displacement systems. | -””- | 2 |
| Laboratory 6 | Rotational and rototranslational motion transmission systems. | -””- | 2 |
| Laboratory 7 | Synthesis of laboratory work. | -””- | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | V. Maties, Mecatronica, Editura Dacia Cluj-Napoca 1998 |
| | Barbu. St., Mecanisme specifice mecanicii fine, Ed. Universității Lucian Blaga Sibiu, 2013 |
| | Barbu. St., Structuri mecanice performante în mecatronică, Ed. Universității Lucian Blaga Sibiu, 2013 |
| | Handra-Luca V., Introducere în teoria mecanismelor, Editura DACIA, 1982 |
| | Dudita F., Transmisii cardanice, Editura Transilvania Expres Brașov, 2003 |
| | |
| | Razmerita Gh., Mecanisme și dinamica mașinilor, Galați, 1998 |

| | |
|---|---|
| 9.2. Additional Bibliography | Demian T.s.a., Mecanisme de mecanică fină, Ed. Didactica și Pedagogică, București, 1982 |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in a formal and informal setting with the representatives of the relevant companies

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 80% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 20% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Programming of microcontrollers | | | Code | MCTEN.507.SA | |
| 2.2. Course coordinator | Prof. PhD. Radu-Eugen BREAZ | | | | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. PhD. Mihai CRENGANIS | | | | | |
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | | C |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 14 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 28 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer programming and programming languages, Electronics, Digital electronics |
| 4.2. Competencies | Basic programming knowledge (algorithms), basic knowledge of electronics, basic knowledge of logic functions and circuits |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video projector, online platforms, etc. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Specific software packages for microcontroller programming |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | design automation components | 0.6 |
| | PC2 | simulate mechatronic design concepts | 0.6 |
| | PC3 | execute analytical mathematical calculations | 0.6 |
| | PC4 | analyse test data | 0.6 |
| | PC5 | develop mechatronic test procedures | 0.5 |
| | PC6 | think abstractly | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0.2 |
| | TC2 | create solutions to problems | 0.2 |
| | TC3 | manage personal professional development | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring knowledge and competences regarding the use and programming of microcontrollers |
| 7.2. Specific course objectives | It is anticipated that after studying this discipline, the students will be able to:<br>• Define the basic concepts within microcontrollers domain<br>• Develop software programs for microcontrollers<br>• Design and implement, individually or in teams control systems based upon microcontrollers |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Microcontrollers, generalities, short history. | Heuristic conversation Explanation Case study | 2 |
| Lecture 2 | The main architectures of microcontrollers. Von Neumann and Harvard architectures. Types of instructions sets: CISC, RISC. | - ” - | 2 |
| Lecture 3 | The structure of microcontrollers. The CPU, the memory. Memory organization. General purpose registers. Registers with special functions. | - ” - | 2 |
| Lecture 4 | Ports and pins. Voltage levels for inputs and outputs. TTL, CMOS, Schmitt trigger technologies. Power pins, reset pins. Sourcing and sinking outputs. Active-low and active-high inputs. | - ” - | 2 |
| Lecture 5 | Microcontrollers of the Microchip PIC family. Assembly language programming. Part I. | - ” - | 2 |
| Lecture 6 | Microcontrollers of the Microchip PIC family. Assembly language programming. Part II. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 7 | AVR microcontrollers on Arduino development boards. Assembly language programming. | - ” - | 2 |
| Lecture 8 | AVR microcontrollers on Arduino development boards. Programming in high-level languages. Part I. | - ” - | 2 |
| Lecture 9 | AVR microcontrollers on Arduino development boards. Programming in high-level languages. Part II. | - ” - | 2 |
| Lecture 10 | AVR microcontrollers on Arduino development boards. Programming in high-level languages. Part III. | - ” - | 2 |
| Lecture 11 | AVR microcontrollers on Arduino development boards. Programming in MATLAB. | - ” - | 2 |
| Lecture 12 | AVR microcontrollers on Arduino development boards. Programming in Simulink. Part I | - ” - | 2 |
| Lecture 13 | AVR microcontrollers on Arduino development boards. Programming in Simulink. Part II. | - ” - | 2 |
| Lecture 14 | Raspberry PI systems. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Application regarding the numerical representation of information. Systems and numbers bases. Conversions. | Heuristic conversation Demonstration Experiment | 2 |
| Laboratory 2 | Software packages for programming Microchip PIC microcontrollers. | - ” - | 2 |
| Laboratory 3 | Development kit with Microchip PIC microcontroller. Applications. | - ” - | 2 |
| Laboratory 4 | Software packages for programming AVR microcontrollers on Arduino development boards. | - ” - | 2 |
| Laboratory 5 | Applications with Arduino systems. Generation of signals on / digital outputs | - ” - | 2 |
| Laboratory 6 | Applications with Arduino systems. Stepper motor control. | - ” - | 2 |
| Laboratory 7 | Applications with Arduino systems. PWM signal generation | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 8 | Applications with Arduino systems. DC motor control. | - ” - | 2 |
| Laboratory 9 | Applications with Arduino systems. Control of servomotors. | - ” - | 2 |
| Laboratory 10 | Applications with Arduino systems. Reading Hall encoders and sensors. | - ” - | 2 |
| Laboratory 11 | Line-following robot with Arduino board. | - ” - | 2 |
| Laboratory 12 | Programming Arduino systems in MATLAB. | - ” - | 2 |
| Laboratory 13 | Programming Arduino systems in Simulink. Part I. | - ” - | 2 |
| Laboratory 14 | Programming Arduino systems in Simulink. Part II. | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Breaz, R., *Microcontroller programming - course* (digital format) |
| | Mihu, I. P., *Programarea în C a microcontrolerelor*, Ed. ULBS, Sibiu, 2008 |
| | Bălan, R., *Microntrolere, Structură și aplicații*, Ed. Todesco, Cluj Napoca, 2002 |
| 9.2. Additional Bibliography | Peatman, J. B., *Design with PIC Microcontrollers*, Ed. Prentice Hall, 1998 |
| | Microchip Technology Inc., *Manuale PIC*, http://www.microchip.com/ |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 70% (minimum 5) | Written questionnaire |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29]<br>• Knowledge about the basic principles of microcontrollers systems<br>• Understanding the functioning of microcontrollers systems and ability to integrate them in simple automation diagrams<br>• Ability to recommend a microcontrollers system depending on application<br>• Understanding the functioning and programming of microcontrollers systems and ability de develop simple programs | | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Prof. PhD. Radu-Eugen Breaz | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Embedded systems | Code | MCTEN.508.SA |
| 2.2. Course coordinator | Prof. PhD. Radu-Eugen BREAZ | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. PhD. Mihai CRENGANIS | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 14 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 28 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer programming and programming languages, Electronics, Digital electronics |
| 4.2. Competencies | Basic programming knowledge (algorithms), basic knowledge of electronics, basic knowledge of logic functions and circuits |

**5. Conditions** (where applicable)

| | | |
|---|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video projector, online platforms, etc. | ... |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Specific software packages for embedded systems programming | ... |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | design automation components | 0.6 |
| | PC2 | simulate mechatronic design concepts | 0.6 |
| | PC3 | execute analytical mathematical calculations | 0.6 |
| | PC4 | analyse test data | 0.6 |
| | PC5 | develop mechatronic test procedures | 0.5 |
| | PC6 | think abstractly | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0.2 |
| | TC2 | create solutions to problems | 0.2 |
| | TC3 | manage personal professional development | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring knowledge and competences regarding the use and programming of embedded systems |
| 7.2. Specific course objectives | It is anticipated that after studying this discipline, the students will acquire:<br>• Knowledge about real time programming about principles and methods<br>• Knowledge about dedicated operating systems for embedded systems |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction. What is an embedded system | Heuristic conversation Explanation Case study | 2 |
| Lecture 2 | Embedded systems. Architecture. | - ” - | 2 |
| Lecture 3 | Embedded systems memory, structure. | - ” - | 2 |
| Lecture 4 | Embedded systems memory, management. | - ” - | 2 |
| Lecture 5 | Programming Embedded Systems. Assembly language. Part I. | - ” - | 2 |
| Lecture 6 | Programming Embedded Systems. Assembly language. Part II. | - ” - | 2 |
| Lecture 7 | Programming Embedded Systems. C language. Part I. | - ” - | 2 |
| Lecture 8 | Programming Embedded Systems. C language. Part II. | - ” - | 2 |
| Lecture 9 | Program writing methods. Bootloader. | - ” - | 2 |
| Lecture 10 | Real Time Operating Systems (RTOS). Execution threads. Synchronizing | - ” - | 2 |
| Lecture 11 | Interrupts. Critical sections. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 12 | Interfacing embedded systems with process. Principles | - ” - | 2 |
| Lecture 13 | Analog to digital conversion. | - ” - | 2 |
| Lecture 14 | PWM signal generation. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Application regarding the numerical representation of information. Systems and numbers bases. Conversions. | Heuristic conversation Demonstration Experiment | 2 |
| Laboratory 2 | Software packages for programming Microchip PIC microcontrollers. | - ” - | 2 |
| Laboratory 3 | Development kit with Microchip PIC microcontroller. Applications. | - ” - | 2 |
| Laboratory 4 | Software packages for programming AVR microcontrollers on Arduino development boards. | - ” - | 2 |
| Laboratory 5 | Applications with Arduino systems. Generation of signals on / digital outputs | - ” - | 2 |
| Laboratory 6 | Applications with Arduino systems. Stepper motor control. | - ” - | 2 |
| Laboratory 7 | Applications with Arduino systems. PWM signal generation | - ” - | 2 |
| Laboratory 8 | Applications with Arduino systems. DC motor control. | - ” - | 2 |
| Laboratory 9 | Applications with Arduino systems. Control of servomotors. | - ” - | 2 |
| Laboratory 10 | Applications with Arduino systems. Reading Hall encoders and sensors. | - ” - | 2 |
| Laboratory 11 | Line-following robot with Arduino board. | - ” - | 2 |
| Laboratory 12 | Programming Arduino systems in MATLAB. | - ” - | 2 |
| Laboratory 13 | Programming Arduino systems in Simulink. Part I. | - ” - | 2 |
| Laboratory 14 | Programming Arduino systems in Simulink. Part II. | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| 8.2.c. Project | | Teaching methods[24] | Hours |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| 8.2.d. Other practical activities | | Teaching methods | Hours |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography


| | |
|---|---|
| 9.1. Recommended Bibliography | Breaz, R., *Microcontroller programming - course* (digital format) |
| | Mihu, I. P., *Programarea în C a microcontrolerelor*, Ed. ULBS, Sibiu, 2008 |
| | Bălan, R., *Microntrolere, Structură și aplicații*, Ed. Todesco, Cluj Napoca, 2002 |
| 9.2. Additional Bibliography | Ball, S., *Embedded Microprocessor Systems. Real World Design,* Ed. Elsevier, 2002 |
| | Microchip Technology Inc., *Manuale PIC*, http://www.microchip.com/ |


## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 70% (minimum 5) | Written questionnaire |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29]<br>• Knowledge about the basic principles of embedded systems;<br>• Understanding the functioning of embedded systems and ability to integrate them in simple automation systems;<br>• Ability to recommend an embedded system depending on application;<br>• Understanding the functioning and programming of embedded systems and ability de develop simple programs. | | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Prof. PhD. Radu-Eugen Breaz | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Artificial intelligence | Code | MCTEN.509.DA |
| 2.2. Course coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 30 |
| Additional learning by using library facilities, electronic databases and on-site information | 18 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | The students are required to have general knowledge acquired in the courses Computer Programming and Programming Languages 1 and 2, Computer Architecture, and Digital Electronics. |
| 4.2. Competencies | Competencies in programming algorithms, analyzing computer system architectures, and developing hardware and software solutions. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Active involvement of students in teaching activities<br>• Availability of teaching support materials |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Active involvement of learners<br>• Preliminary understanding of the main course objectives |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 4 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Analyzes test data | 1 |
| | PC2 | Develops procedures for testing products, systems, and electronic components | 0.5 |
| | PC3 | Performs analytical mathematical calculations | 0.5 |
| | PC4 | Examines technical principles | 0.5 |
| **6.2. Transversal competencies** | TC1 | Manages personal professional development | 0.5 |
| | TC2 | Finds solutions to problems | 0.5 |
| | TC3 | Synthesizes information | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The general objective of the course is to provide students with knowledge and skills in designing, analyzing, and testing computing systems and artificial intelligence applications, using advanced simulation and modeling methods, while adhering to safety and optimization standards. |
| 7.2. Specific course objectives | At the end of this course, students will be able to:<br>• Apply fundamental artificial intelligence techniques, including search, machine learning, and knowledge representation.<br>• Design and implement AI-based solutions for solving complex problems.<br>• Develop predictive models using machine learning methods and optimize training and evaluation processes.<br>• Analyze and interpret data resulting from the implementation of AI algorithms and evaluate their performance. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Artificial Intelligence | Lecture, Heuristic conversation, Explanation, Case study | 2 |
| Lecture 2 | Intelligent Agents | - ” - | 2 |
| Lecture 3 | Search Algorithms (Part I: Uninformed Search) | - ” - | 2 |
| Lecture 4 | Search Algorithms (Part II: Informed Search and Heuristics) | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Search Algorithms (Part III: Adversarial Search and Minimax Algorithms) | - ” - | 2 |
| Lecture 6 | Knowledge Representation (Part I: Propositional Logic and Predicates) | - ” - | 2 |
| Lecture 7 | Knowledge Representation (Part II: Semantic Networks and Frames) | - ” - | 2 |
| Lecture 8 | Machine Learning (Part I: Regression and Classification) | - ” - | 2 |
| Lecture 9 | Machine Learning (Part II: Supervised and Unsupervised Learning Methods) | - ” - | 2 |
| Lecture 10 | Neural Networks (Part I: Neural Network Architecture) | - ” - | 2 |
| Lecture 11 | Neural Networks (Part II: Learning and Optimization Algorithms) | - ” - | 2 |
| Lecture 12 | Ethics in Artificial Intelligence | - ” - | 2 |
| Lecture 13 | Hardware Architectures for AI | - ” - | 2 |
| Lecture 14 | AI Applications in Industry | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Introduction to Graphs: Graphical and Matrix Representation of Undirected Graphs | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Traversal of Undirected Graphs: BFS (Breadth-First Search) and DFS (Depth-First Search) Algorithms | - ” - | 2 |
| Laboratory 3 | Directed Graphs: Representation and Traversal with Search Algorithms | - ” - | 2 |
| Laboratory 4 | Trees: Representation and Properties of Binary Trees and Tree Structures | - ” - | 2 |
| Laboratory 5 | A* Search Algorithm in Directed and Undirected Graphs | - ” - | 2 |
| Laboratory 6 | Depth-Limited Search and Iterative Deepening Search in Trees | - ” - | 2 |
| Laboratory 7 | Applying the Minimax Search Algorithm in Graphs and Trees for Games | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press. |
| | Russell, S. J., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach (4th ed.). Pearson. |
| | Sutton, R. S., & Barto, A. G. (2018). Reinforcement Learning: An Introduction (2nd ed.). MIT Press. |

| | |
|---|---|
| | Leskovec, J., Rajaraman, A., & Ullman, J. D. (2020). Mining of Massive Datasets (3rd ed.). Cambridge University Press. |
| | Silver, D., & Hassabis, D. (2021). Mastering the Game of Go with Deep Neural Networks and Tree Search. Nature, 529(7587), 484-489. |
| | Chollet, F. (2017). Deep Learning with Python. Manning Publications. |
| 9.2. Additional Bibliography | Murphy, K. P. (2012). Machine Learning: A Probabilistic Perspective. MIT Press. |
| | Géron, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (2nd ed.). O'Reilly Media. |
| | Zaki, M. J., & Meira, W. (2014). Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in both formal and informal settings with representatives of specialized companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 20% | 70% (minimum 5) | Minimum attendance: 50% at lectures Exam: written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 80% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | Minimum attendance: 100% at laboratories CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Gabriela-Petruța POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Microcontrollers, microprocessors | | | Code | MCTEN.510.DA | |
| 2.2. Course coordinator | Lecturer PhD. Gabriela-Petruța POPP | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța POPP | | | | | |
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 30 |
| Additional learning by using library facilities, electronic databases and on-site information | 18 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer Programming and Programming Languages, Electronics, Digital Electronics. |
| 4.2. Competencies | Basic knowledge of programming (algorithms), basic knowledge of electronics, basic knowledge of functions and logic circuits. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Whiteboard, projector, online platforms, etc. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Specific software packages for programming microcontrollers and microprocessors. |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | 4 |
| **6.1. Professional competencies** | PC1 | Defines technical requirements | 1 |
| | PC2 | Develops testing procedures for products, systems, and electronic components | 0.5 |
| | PC3 | Designs automation components | 0.5 |
| | PC4 | Tests mechatronic units | 0.5 |
| **6.2. Transversal competencies** | TC1 | Manages personal professional development | 0.5 |
| | TC2 | Finds solutions to problems | 0.5 |
| | TC3 | Synthesizes information | 0.5 |

Credits distribution by competencies[19]

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquisition of knowledge and skills regarding the use and programming of systems with microcontrollers and microprocessors. |
| 7.2. Specific course objectives | It is anticipated that through the study of this course, students will be able to:<br>• Define the basic concepts in the field of microcontroller and microprocessor systems<br>• Be able to develop programs for systems with microcontrollers and microprocessors<br>• Design and implement, individually and/or in teams, automation systems based on microcontroller and microprocessor systems. |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | Microcontrollers, Microprocessors – General Concepts. Basic Functions of the Microprocessor. | Lecture, Heuristic conversation, Explanation, Case study | 2 |
| Lecture 2 | The von Neumann and Harvard Architectures. Basic architecture of a microprocessor. Standard structure of the microprocessor. Arithmetic and Logic Unit (ALU). Control and Command Unit. Register group. | - ” - | 2 |
| Lecture 3 | The bus concept. Data bus. Address bus. Control bus. | - ” - | 2 |
| Lecture 4 | Hardware structure. Control function. Memory function. Arithmetic-logic function. Input/output function. Microprogramming. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Internal memory. RAM memory. ROM memory. Typical organization of the microprocessor system memory. | - ” - | 2 |
| Lecture 6 | Microprocessor system software – general aspects. Addressing modes. Microprocessor instruction set. Stack. Assembly language. Program development. | - ” - | 2 |
| Lecture 7 | Input/Output (I/O) elements of microprocessor systems. I/O operations performed under program control. I/O operations performed through interrupts. I/O operations performed via direct memory access. | - ” - | 2 |
| Lecture 8 | Intel 80x86 microprocessors. Architecture. Execution unit. Bus interface unit. Registers. | - ” - | 2 |
| Lecture 9 | Instruction set of Intel 80x86 microprocessors. Assembly language instruction syntax. Instruction groups. Memory addressing techniques. Addressing modes. Working with stacks and subroutines. Interrupt system. | - ” - | 2 |
| Lecture 10 | PIC Microchip Microcontrollers. Architecture and programming. Programming in assembly language. | - ” - | 2 |
| Lecture 11 | PIC Microchip Microcontrollers. Programming in high-level languages (HLL). | - ” - | 2 |
| Lecture 12 | PIC (ATMEL) AVR Microcontrollers. Architecture and programming. Programming in assembly language. | - ” - | 2 |
| Lecture 13 | PIC (ATMEL) AVR Microcontrollers. Architecture and programming. Programming in high-level languages (HLL). | - ” - | 2 |
| Lecture 14 | Techniques for improving microprocessor performance. Parallelism – the technique for faster processing. Prefetch queue. Pipeline – overlapping the execution of multiple instructions. Cache memory – multiple memory access paths. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Applications on Numerical Representation of Information. Number Systems and Bases. Conversions. | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Microchip PIC Microcontroller Development Kit. Applications. Part I. | - ” - | 2 |
| Laboratory 3 | Microchip PIC Microcontroller Development Kit. Applications. Part II. | - ” - | 2 |
| Laboratory 4 | Applications with Arduino Systems. Generating Signals on Digital Inputs/Outputs. | - ” - | 2 |
| Laboratory 5 | Applications with Arduino Systems. Stepper Motor Control. | - ” - | 2 |
| Laboratory 6 | Applications with Arduino Systems. Generating PWM Signals. | - ” - | 2 |
| Laboratory 7 | Applications with Arduino Systems. Servo Motor Control. | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| 8.2.d. Other practical activities | Teaching methods | Hours |
|---|---|---|
| **Total other practical activities hours:** | | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Breaz, R., Microcontrolere - curs (format digital) |
| | Mihu, I. P., Programarea în C a microcontrolerelor, Ed. ULBS, Sibiu, 2008 |
| | Dobriceanu, M., Sisteme cu microprocesoare, Ed. Universitaria Craiova, 2012 |
| 9.2. Additional Bibliography | Peatman, J. B., Design with PIC Microcontrollers, Ed. Prentice Hall, 1998 |
| | Microchip Technology Inc., Manuale PIC, http://www.microchip.com/ |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through periodic discussions in both formal and informal settings with representatives of specialized companies.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 70% (minimum 5) | Minimum attendance: 50% at lectures Exam: written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | Minimum attendance: 100% at laboratories CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Gabriela-Petruța POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Systems and technics of measurement | Code | MCTEN.601.SO |
| 2.2. Course coordinator | Lecturer PhD Alexandru BÂRSAN | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD Alexandru BÂRSAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 14 |
| Additional learning by using library facilities, electronic databases and on-site information | 8 |
| Preparing seminars / laboratories, homework, portfolios and essays | 11 |
| Tutorial activities[9] | 7 |
| Exams[10] | 3 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer-aided graphics, Materials science and engineering, Tolerances and Dimensional control |
| 4.2. Competencies | Computer literacy skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Board, video projector, specific teaching materials, online platforms |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Computing technology, software packages, experimental stands, online platforms |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | 3 |
| | | | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | analyse test data | 0,5 |
| | PC2 | conduct quality control analysis | 0,5 |
| | PC3 | develop mechatronic test procedures | 0,3 |
| | PC4 | execute analytical mathematical calculations | 0,4 |
| | PC5 | record test data | 0,4 |
| | PC6 | perform data analysis | 0,4 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0,2 |
| | TC2 | create solutions to problems | 0,2 |
| | TC3 | think abstractly | 0,1 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The course aims to familiarize students with the basics of metrology, measurement methods and means used for the determination of different quality characteristics of mechatronic systems. |
| 7.2. Specific course objectives | It is anticipated that students will be able:<br>• to interprets the results based on the evaluation of measurement errors and uncertainties;<br>• to facilitate the organic connection between theoretical and practical solutions to achieve measurement and control schemes of different sizes. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction, terminology, test methods; General terms of metrology. Quantities and units; Systems of measurement units. | Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students | 2 |
| Lecture 2 | General quality control; Conditions imposed on the measurements. | - ” - | 2 |
| Lecture 3 | Size measurement; Measurement; The measurement. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Factors influencing the measurement; Errors and uncertainties of measurement. | - ” - | 2 |
| Lecture 5 | Assessment of errors, processing and presentation of measurement results. | - ” - | 2 |
| Lecture 6 | Measuring instruments. Structures. | - ” - | 2 |
| Lecture 7 | Metrological characteristics. | - ” - | 2 |
| Lecture 8 | Measurement methods. | - ” - | 2 |
| Lecture 9 | Establishing test methods according to the destination of products. | - ” - | 2 |
| Lecture 10 | Standardisation. | - ” - | 2 |
| Lecture 11 | Standards. | - ” - | 2 |
| Lecture 12 | Measuring amplifiers. General. Reaction. The operational amplifier. instrumental amplifier. | - ” - | 2 |
| Lecture 13 | Oscilloscopes; Electrical measuring instruments, measuring bridges. | - ” - | 2 |
| Lecture 14 | Colloquium. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | 0 |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Safe Laboratory Practices & Procedures. Presentation of the laboratory and themes. | Practical demonstration, exercise | 2 |
| Laboratory 2 | Tools and laboratory equipment; General aspects of sampling. | - ” - | 2 |
| Laboratory 3 | Qualitative analysis methods for conducting the tests. | - ” - | 2 |
| Laboratory 4 | Processing and interpretation of test results. | - ” - | 2 |
| Laboratory 5 | Metrological verification of measuring instruments. | - ” - | 2 |
| Laboratory 6 | Optical 3D measurement systems. | - ” - | 2 |
| Laboratory 7 | Summary of laboratory work. | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | 0 |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | 0 |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Ernest O. Doebelin, *Measurement Systems: Application and Design*, 5th edition, McGraw-Hill, 2004. |
| | John P. Bentley, *Principles of Measurement Systems*, 4th edition, Pearson Education, 2005. |
| | William C. Dunn, *Fundamentals of Industrial Instrumentation and Process Control*, 2nd edition, McGraw-Hill, 2018. |
| | Robert B. Northrop, *Introduction to Instrumentation and Measurements*, 4th edition, CRC Press, 2018. |

| | |
|---|---|
| 9.2. Additional Bibliography | Zeiss Quality Suite, documentation / tech guide, 2024 |
| | Nakra B. C. and Chaudhry K. K., *Instrumentation, Measurement, and Analysis*, 4th edition, McGraw-Hill Education, 2021. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | % | 60% (minimum 5) | Written |
| | | Homework: | 50% | | |
| | | Other activities[28]: | % | | |
| | | Final evaluation: | 50% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 40% (minimum 5) | CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | Grade 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Lecturer PhD Alexandru Bârsan | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Machine tools and manufacturing | Code | MCTEN.602.SO |
| 2.2. Course coordinator | Lecturer PhD. Eng. Mihai-Octavian POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Eng. Mihai-Octavian POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Technical drawing, Mechanics, Materials fatigue, Machine parts, Mechanisms. |
| 4.2. Competencies | Basic engineering knowledge, computer-aided operation and design, metrology and measurement technology |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and application presentations; reading training materials and recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned laboratory works; active participation; agreement to perform practical work under the supervision of the teacher and analyst |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 4 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Adjust engineering designs | 0.5 |
| | PC2 | Conduct quality control analysis | 0.5 |
| | PC3 | Design prototypes | 0.5 |
| | PC4 | Record test data | 0.5 |
| | PC5 | Follow standards for machinery safety | 0.5 |
| | PC6 | Synthesise information | 0.5 |
| **6.2. Transversal competencies** | TC1 | Synthesise information | 0.5 |
| | TC2 | Create solutions to problems | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge, understanding of concepts, explanation, interpretation of basic methods of construction, kinematics and operation of machine tools and processing systems. |
| 7.2. Specific course objectives | Acquisition of knowledge on the commissioning, operation, maintenance of machine tools and processing systems |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Basic concepts of cutting. | Lecture: problem solving, exposure synthetic explanations, demonstration by charts, graphs. Method: learning through discovery and case study. | 2 |
| Lecture 2 | Basic concepts of cutting. | -””- | 2 |
| Lecture 3 | Surface manufacture of machines parts on machine tools. | -””- | 2 |
| Lecture 4 | Basic concepts of the kinematic chains of machine tools. | -””- | 2 |
| Lecture 5 | Kinematic structure of machine tools: motion frequency control mechanisms, reversing mechanisms, summation mechanisms, fragmentation mechanisms, motion transformation mechanisms. | -””- | 2 |
| Lecture 6 | Kinematic structure of machine tools: motion frequency control mechanisms, reversing | -””- | 2 |

| | | | |
|---|---|---|---|
| | mechanisms, summation mechanisms, fragmentation mechanisms, motion transformation mechanisms. | | |
| Lecture 7 | Drilling and boring machine tools. | -””- | 2 |
| Lecture 8 | Planning and grinding machine tools. Broaching machine tools. | -””- | 2 |
| Lecture 9 | Milling machine tools. | -””- | 2 |
| Lecture 10 | Turning machine tools. | -””- | 2 |
| Lecture 11 | Grinding machine tools. | -””- | 2 |
| Lecture 12 | Machine tools for machining gears. | -””- | 2 |
| Lecture 13 | CNC Machines. | -””- | 2 |
| Lecture 14 | CNC Machines. | -””- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Study of the G40 vertical drilling machine; Study of the S425 shaping machine. | Individual study of the work stands followed by practical tests and laboratory equipment; experiment used as method. | 2 |
| Laboratory 2 | Study of the FUS 32 milling machine. | -””- | 2 |
| Laboratory 3 | Study of the SN 320 lathe. | -””- | 2 |
| Laboratory 4 | Study of the RU100 grinding machine. | -””- | 2 |
| Laboratory 5 | Study of the AF85 boring and milling machine. | -””- | 2 |
| Laboratory 6 | Study of the machine of the FD 500 gear milling machine. | -””- | 2 |
| Laboratory 7 | Study of the CNC milling machine Haas. | -””- | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Fetche, V., *Maşini-unelte* , Ed. “Alma Mater”, Sibiu, 2002 |
| | Fetche, V. s.a. *Masini unelte*, vol I, II, III, indrumar de laborator, Ed. Univ., Sibiu,1991 |
| | Popp I. - *Exploatarea, reglarea si intretinerea masinilor unelte* – *Aplicatii* – Ed ULB Sibiu 2003 |
| | Telea D., Fetche V., Popp I., *MAŞINI - UNELTE* - Construcţia şi cinematica, Ed ULB Sibiu, 1997 |

| | |
|---|---|
| | Racz G., Cojocaru S., *Proiectarea masinilor si utilajelor-Teoria: Structura cinematica*, Ed ULB, 2003. |
| | Diaconescu, *Exploatarea Maşinilor Unelte,* – Ed. Didactica, Buc. 1985. |
| | Morar, L., Pâslă, A., Ciortea, M., *Sisteme integrate de prelucrare*, Ed Dacia, Cluj-Napoca, 1998 |
| | Fetche, V., *Maşini-unelte* , Ed. "Alma Mater", Sibiu, 2002 |
| | Badea Lepadatescu, C. Buzatu - Masini unelte si prelucrari prin aschiere, Ed.Matrixrom, 2003 |
| | Gh. Soare, Laurentiu Rece - Masini-unelte si prelucrari mecanice. Ghid tehnologic si indrumar de laborator, Ed.Matrixrom, 2016 |
| | Racz, G., Mașini și sisteme de producție, note de curs, 2010. |
| | Ispas, C., ş.a., Maşini-unelte, Elemente de structură, Editura Tehnică, Bucureşti,1997 |
| | |
| 9.2. Additional Bibliography | Racz, G., Cojocaru, S., Proiectarea maşinilor şi utilajelor. Teoria. , Editura Universităţii „Lucian Blaga" din Sibiu, 2003 |
| | Telea D., Popp I., Breaz R., *Maşini, echipamente şi strategii în sisteme flexibile de producţie*, Editura DACIA, Cluj-Napoca, 2008. |
| | Botez, E., *Maşini unelte,* , vol.1, 2, 3, 4, Ed. Tehnica, Bucuresti 1984. |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in a formal and informal setting with the representatives of the relevant companies

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 80% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 20% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Hydronics and Pneutronics 2 | Code | MCTEN.604.SO |
| 2.2. Course coordinator | PhD. Prof. Eng. Eugen AVRIGEAN | | |
| 2.3. Seminar/laboratory coordinator | PhD student. Asst. Eng. Fineas MORARIU | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 0 | 1 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 0 | 14 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 15 |
| Additional learning by using library facilities, electronic databases and on-site information | 8 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge of mechanics, strength of materials, machine parts, mechanisms, fluid mechanics |
| 4.2. Competencies | Computer skills (minimum Office, Internet browser) |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation<br>Lecturing the course |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Reading the recommended bibliography<br>Writing and presenting planned papers<br>Active participation |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | install automation components; | 1 |
| | PC2 | define technical requirements. | 1 |
| | PC3 | | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | apply blended learning. | 1 |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge of and understanding concepts, theories and basic methods of projecting hydraulic actioning and commanding systems of machine-tools and production systems; |
| 7.2. Specific course objectives | It is anticipated that by the end of the course, the students will be able to:<br>- design and implement drivelines of medium and high complexity;<br>- action, operate and maintain machine-tools and production systems;<br>- respect personal characteristics. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Automatic hydraulic systems | Lecturing supported by using modern methods of image projection. | 2 |
| Lecture 2 | Automatic hydraulic systems. Hydraulic copying | - ” - | 2 |
| Lecture 3 | Hydraulic proportional and servo valve operation | - ” - | 2 |
| Lecture 4 | Electro-hydraulic servo valve systems used in cars and machines | - ” - | 2 |
| Lecture 5 | Analysis and synthesis of automatic hydraulic systems | - ” - | 2 |
| Lecture 6 | Hydraulic circuits for speed and pressure control | - ” - | 2 |
| Lecture 7 | Hydraulic circuits with accumulators | - ” - | 2 |
| Lecture 8 | Programmable hydraulic circuits | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 9 | Specific aspects of hydraulic consumer installation to cars and machines | - ” - | 2 |
| Lecture 10 | Generator drivelines powered hydraulically in cars and machines | - ” - | 2 |
| Lecture 11 | Secondary drivelines powered hydraulically in cars and machines | - ” - | 2 |
| Lecture 12 | Hydrostatic systems used in cars and machines | - ” - | 2 |
| Lecture 13 | The design of hydraulic systems | - ” - | 2 |
| Lecture 14 | Hydraulic system automation technology used in cars and machines | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | | | |
| Laboratory 2 | | | |
| Laboratory 3 | | | |
| Laboratory 4 | | | |
| Laboratory 5 | | | |
| Laboratory 6 | | | |
| Laboratory 7 | | | |
| Laboratory 8 | | | |
| Laboratory 9 | | | |
| Laboratory 10 | | | |
| Laboratory 11 | | | |
| Laboratory 12 | | | |
| Laboratory 13 | | | |
| Laboratory 14 | | | |

| | |
|---|---|
| **Total laboratory hours:** | |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | Defining the topic. Bibliography. Methodological directions | Experiment, heuristic methods | 2 |
| Project 2 | Choosing the best option of the mount scheme and creating the cyclograms of the component elements (operational plan) that contain the following data: the engine number (that has to correspond to the one in the disposal plan), naming these engines and their dimensions, indicating the engine position, the forces and speed that the engines have to reach (fast movement – fast withdrawal – technological advance), commands and control of various movements, numbering the movements (the same as in the disposal plan). The space (movement) is indicated on the ordinate, and time on the abscissa. | - ” - | 2 |
| Project 3 | Making the actioning operating sketch and the command and implementation cyclogram | - ” - | 2 |
| Project 4 | Systematization of design data and design calculations for one or more actioning circuits. Choosing, coding, commanding and controlling actuators | - ” - | 2 |
| Project 5 | Partial or total design of the actuation, control and command panel | - ” - | 2 |
| Project 6 | Finalizing and delivering the project | - ” - | 2 |
| Project 7 | Project presentation | - ” - | 2 |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | **14** |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |

| | |
|---|---|
| **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Racz, S., G., Girjob, C., E., Biris, C., M., Sisteme hidraulice de actionare : Indrumar de laborator Editura Universitatii "Lucian Blaga", Sibiu, 2016. |
| | Bârsan, I., Racz, S., G., Actionari hidraulice si pneumatice : Aplicatii, Editura Universitatii "Lucian Blaga", Sibiu, 2003. |
| | Racz, S., G., Girjob, C., E., Sisteme hidraulice de actionare : Pentru uzul studentilor, Editura Universitatii "Lucian Blaga", Sibiu, 2016. |
| | Bârsan, I., Popp, I., Bogdan, L., Telea, D., Fetche, V. - Acţionări şi automatizări hidraulice. Elemente de proiectare, Editura Universitatii "Lucian Blaga", Sibiu, 1996. |
| | Tero, M., Actionari hidraulice si pneumatice: Pentru uzul studentilor, Editura Universității „Petru Maior”, Târgu Mureș, 2013. |
| | David, I., Ștefănescu, C., Hidraulică: teme aplicative, Editura Politehnica, Timișoara, 2013. |
| | Pădurean, I., Hidraulică și sisteme de acționare: compendium, Editura Eurostampa, Timișoara, 2012. |
| | Bordeașu, I., Păcurar, C., Bordeașu, D., Hidraulică: noțiuni teoretice și probleme de hidrostatică, Editura Politehnica, Timișoara, 2017. |
| | Axinti, A.S., Șcheaua, F.D., Introducere în hidraulica industrială, Editura Galați University Press, Galați, 2015 |
| | |
| 9.2. Additional Bibliography | Ispas, V., ş.a. - Roboţi industriali, Ed. Didactică Cluj Napoca '85. |
| | Ionescu, Fl. - Mecanica fluidelor şi acţionari hidraulice şi pneumatice, Ed. Didactică şi pedagogică Bucureşti '80. |
| | Ivan, M., Maniut, P., Cristian, I., Dobre, G. - Hidraulica maşinilor unelte, Ed. Universitatea Braşov '89. |
| | * https://www.lunchboxsessions.com/ |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in formal and informal meetings with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 60% (minimum 5) | Written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | 0% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | 40% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | PhD. Prof. Eng. Eugen AVRIGEAN | |
| **Study Program Coordinator** | PhD. Lect. Eng. Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Baechlor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Equipment and manufacturing technologies in mechatronics | Code | MCTEN.606.SO |
| 2.2. Course coordinator | Associate professor PhD. Cristina Maria BIRIȘ | | |
| 2.3. Seminar/laboratory coordinator | Assistant PhD. Dan Mihai RUSU | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 18 |
| Preparing seminars / laboratories, homework, portfolios and essays | 20 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | - |
| 4.2. Competencies | - |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, Reading support material |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Making practical tests for plastics, Active participation, Teamwork |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | adjust engineering designs | 2 |
| | PC2 | test mechatronic units | 1 |
| | PC3 | | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | create solutions to problems | 0.5 |
| | TC2 | manage personal professional development | 0.5 |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The general aims of this course are to present:<br>- the characteristics and the properties of the main plastics materials;<br>- the principles of the processing of plastics. |
| 7.2. Specific course objectives | The specific objectives of this course are to present:<br>- the characteristics and the properties of the plastic.<br>- the principles of the processing of plastics (compression molding, transfer molding, injection molding, extrusion, thermoforming, a.s.o);<br>- the principles of product design.<br>- the principles on the mold design.<br>- the characteristics of the plastics processing machines and their main components. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Thermosetting and thermoplastic materials. Plastics additives. | Classical lecture, assisted by using video-projector | 2 |
| Lecture 2 | Plastics additives. | | 2 |
| Lecture 3 | Plastics properties and testing. | | 2 |
| Lecture 4 | Injection molding: theory, technologies, injection systems | | 2 |
| Lecture 5 | Injection molding: mechanical design of injection molds | | 2 |
| Lecture 6 | Injection molding: design of parts | | 2 |
| Lecture 7 | Injection molding machines. | | 2 |
| Lecture 8 | Injection molding: peripheral equipment (conveyor, robots a.s.o.) | | 2 |
| Lecture 9 | Special injection technologies: Reaction injection molding, Gas assist injection molding | | 2 |

| | | | |
|---|---|---|---|
| Lecture 10 | Special injection technologies: Co-injection molding, Two-shut injection molding | | 2 |
| Lecture 11 | Extrusion: theory, technologies, single screw and twin screw extruders | | 2 |
| Lecture 12 | Extrusion: blown film extrusion, flat film extrusion, tube extrusion, co-extrusion, pultrusion. | | 2 |
| Lecture 13 | Equipment of an extrusion line: calibration system, heating- cooling system, transport system, cutting system. | | 2 |
| Lecture 14 | Thermoforming: vacuum forming, pressure forming, mechanical forming. | | 2 |
| | | **Total lecture hours:** | **28** |

| **8.2.b. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Visual methods of analysis and thermal testing methods for plastics | Conversation, experiment, heuristics methods | 2 |
| Laboratory 2 | Tensile testing of plastics | | 2 |
| Laboratory 3 | Basic injection molds design and die-work influencing factors | | 2 |
| Laboratory 4 | The clasifications of injection molding machines, the characteristics of the injection molding machines and the main components (injection unit, clamping unit, motor drive, heating system, control unit) | | 2 |
| Laboratory 5 | Adjusting process parameters of injection molding machine | | 2 |
| Laboratory 6 | Experimental determination of flow capacity of thermoplastic materials | | 2 |
| Laboratory 7 | Study of vacuum thermoforming process | | 2 |
| | | **Total laboratory hours:** | 14 |

## 9. Bibliography


| | |
|---|---|
| 9.1. Recommended Bibliography | Malloy R., Plastic Part Design for Injection Molding, Hanser Publishers, Munich, 2010 |
| | Jones P., The mould design guide, Smithers Rapra Technology Limited, 2008 |
| | Campo A., The complete part design handbook for injection molding of thermoplastic, Hanser Publishers, Munich, 2006 |
| | Dangel R., Injection moulds for beginners, Hanser Publishers, Munich, 2012 |
| | Kazmer D.O., Injection mold design engineering, Hanser Publishers, Munich, 2016 |
| | Rosato D., Rosato M.m Injection molding handbook, Kluwer Academic Publishers, Boston, 2000, |
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| 9.2. Additional Bibliography | Design Solution Guide, BASF Corporation Engineering Plastics, 2007. |
| | Stoeckhert M, Mold making handbook, Hanser Publishers, Munich, 2013 |
| | |
| | |
| | |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]**

| |
|---|
| Design and implementation of activities, projects in order to apply skills acquired in the study of discipline |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[25]: | 40% | 70% (minimum 5) | Oral Exam |
| | | Homework: | 10% | | |
| | | Other activities[26]: | % | | |
| | | Final evaluation: | 50% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |
| 11.5 Minimum performance standard[27] | | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Associate professor PhD Cristina Maria BIRIȘ | |
| **Study Program Coordinator** | Associate professor PhD Mihai CRENGANIȘ | |
| **Head of Department** | Associate professor PhD Claudia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Software for virtual instrumentation | Code | MCTEN.607.SO |
| 2.2. Course coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 15 |
| Additional learning by using library facilities, electronic databases and on-site information | 10 |
| Preparing seminars / laboratories, homework, portfolios and essays | 8 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **33** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Courses that must be successfully completed first: Computer Programming and Programming Languages, Electronics, Computer Architecture |
| 4.2. Competencies | Students should have basic skills in programming algorithms and graphical interfaces, experience with simulation and modeling software, ability to analyze and interpret collected data, and competencies in hardware-software interfacing for integrating physical instruments with virtual systems. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Lecture hall equipped with a projector and access to online platforms. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Laboratory equipped with computers, virtual instrumentation software, and interfacing hardware for hands-on activities. |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 3 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Analyzes test data | 0.5 |
| | PC2 | Develops testing procedures for products, systems, and electronic components | 0.5 |
| | PC3 | Execute analytical mathematical calculations | 0.5 |
| **6.2. Transversal competencies** | TC1 | Manage personal professional development | 0.5 |
| | TC2 | Synthesise information | 0.5 |
| | TC3 | Create solutions to problems | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The main objective of the course is to equip students with the knowledge and skills necessary to develop, implement, and analyse virtual instrumentation systems, using specialized software to simulate and test electronic and mechatronic systems. |
| 7.2. Specific course objectives | • Develop the ability to design and implement test procedures for virtual instrumentation systems.<br>• Apply analytical mathematical calculations to interpret and process data in a virtual instrumentation environment.<br>• Simulate and validate mechatronic design concepts using virtual instrumentation tools.<br>• Perform data analysis and synthesize information from test results and simulations.<br>• Use technical drawing and simulation software to design and document virtual instrumentation systems. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Virtual Instrumentation | Lecture, Heuristic conversation, Explanation, Case study | 2 |
| Lecture 2 | Basic Concepts of Data Acquisition | - ” - | 2 |
| Lecture 3 | Software Architectures for Virtual Instrumentation Systems | - ” - | 2 |
| Lecture 4 | Signal Processing in Virtual Instrumentation | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Graphical Programming for Instrumentation (LabVIEW or similar tools) | - ” - | 2 |
| Lecture 6 | Interfacing Hardware with Virtual Instrumentation Systems | - ” - | 2 |
| Lecture 7 | Data Acquisition Hardware: Sensors and Actuators | - ” - | 2 |
| Lecture 8 | Real-time Data Processing and Analysis | - ” - | 2 |
| Lecture 9 | Virtual Instrumentation for Mechatronic Systems | - ” - | 2 |
| Lecture 10 | Automation and Control Using Virtual Instruments | - ” - | 2 |
| Lecture 11 | Simulation and Testing of Electronic Systems | - ” - | 2 |
| Lecture 12 | Developing User Interfaces for Virtual Instruments | - ” - | 2 |
| Lecture 13 | Error Analysis and Calibration in Virtual Instrumentation | - ” - | 2 |
| Lecture 14 | Applications of Virtual Instrumentation in Industry | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Introduction to LabVIEW: Creating Your First Virtual Instrument | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Data Acquisition and Signal Measurement Using LabVIEW | - ” - | 2 |
| Laboratory 3 | Building User Interfaces for Virtual Instruments in LabVIEW | - ” - | 2 |
| Laboratory 4 | Signal Processing Techniques in LabVIEW | - ” - | 2 |
| Laboratory 5 | Interfacing Sensors and Actuators with LabVIEW | - ” - | 2 |
| Laboratory 6 | Control Systems Implementation Using LabVIEW | - ” - | 2 |
| Laboratory 7 | Data Logging and Analysis with LabVIEW | - ” - | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Bishop, C. M. (2019). Pattern Recognition and Machine Learning. Springer. |
| | Liu, H. (2017). Virtual Instrumentation: Methods and Applications. Springer. |
| | Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson. |
| | Young, J. (2020). LabVIEW for Engineers (3rd ed.). Cengage Learning. |
| | Cruz, F. J. (2019). Data Acquisition and Control with LabVIEW. Wiley. |
| 9.2. Additional Bibliography | Snyder, J. W., & Schmid, K. (2016). LabVIEW: A Developer's Guide to Real-World Applications. O'Reilly Media. |

| | |
|---|---|
| | Pérez, J. C., & Blanco, J. (2021). Virtual Instrumentation Using LabVIEW: A Practical Approach. Elsevier. |
| | Sharma, S., & Gupta, R. (2022). Advanced LabVIEW Techniques for Embedded Systems. CRC Press. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in both formal and informal settings with representatives of specialized companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 70% (minimum 5) | Minimum attendance: 50% at lectures Exam: written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | Minimum attendance: 100% at laboratories CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Gabriela-Petruța POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Sensors and sensorial systems | Code | MCTEN.608.DO |

| | | | | | |
|---|---|---|---|---|---|
| 2.2. Course coordinator | Lecturer PhD. Eng. Mihai-Octavian POPP | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Eng. Mihai-Octavian POPP | | | | |
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 10 |
| Additional learning by using library facilities, electronic databases and on-site information | 4 |
| Preparing seminars / laboratories, homework, portfolios and essays | 5 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *($NOSI_{sem}$)*** | **19** |
| **3.4. Total Hours in the Curriculum *($NOAD_{sem}$)*** | **56** |
| **3.5. Total Hours per Semester[12] *($NOAD_{sem} + NOSI_{sem}$)*** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Physics, Electronics, Basics of mechatronic systems |
| 4.2. Competencies | Basic engineering knowledge, computer-aided operation and design, metrology and measurement technology |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and application presentations; reading training materials and recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned laboratory works; active participation; agreement to perform practical work under the supervision of the teacher |

**6. Specific competencies acquired[17]**

| | | Number of credits assigned to the discipline[18] | 3 | Credits distribution by competencies[19] |
|---|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Adjust engineering designs | | 0.5 |
| | PC2 | Analyse test data | | 0.5 |
| | PC3 | Develop electronic test procedures | | 0.5 |
| | PC4 | Execute analytical mathematical calculations | | 0.5 |
| **6.2. Transversal competencies** | TC1 | Synthesise information | | 0.5 |
| | TC2 | Create solutions to problems | | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Preparing graduates of mechatronic and robotics on the general concepts related to physical quantities of mechanical, thermal, etc., in various fields, how to change them and use different types of sensory systems in conjunction with these sizes. |
| 7.2. Specific course objectives | Acquiring knowledge about the different types of sensors, operating principle and the use of their sensors suitable choice on which to establish the appropriate transducer structure. Acquisition of the design concepts of principle different types of transducers. Study the most important types of sensory systems: physical construction, components, assembly, installation, operation. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Getting on the different types of processes and materials processing, identifying underlying quantities carry different types of processes: physical quantities (physical parameters) that characterize displacements, velocities, accelerations, quantities characterizing the flow, pressure, physical sizes accompanying temperature condition, physical quantities that characterize the level of a liquid. | Lecture: problem solving, exposure synthetic explanations, demonstration by charts, graphs. Method: learning through discovery and case study | 2 |
| Lecture 2 | Getting on the different types of processes and materials processing, identifying underlying quantities carry different types of processes: physical quantities (physical parameters) that characterize displacements, velocities, accelerations, quantities characterizing the flow, pressure, physical sizes accompanying temperature condition, physical quantities that characterize the level of a liquid. | -""- | 2 |
| Lecture 3 | Equations transducers, types of transducers: establishment of a transducer transfer function, general | -""- | 2 |

| | | | |
|---|---|---|---|
| | classification of transducers; Convert quantities by a transducer | | |
| Lecture 4 | Equations transducers, types of transducers: establishment of a transducer transfer function, general classification of transducers; Convert quantities by a transducer | -""- | 2 |
| Lecture 5 | Transducers to measure geometrical quantities: the measurement of diameters, lengths, etc., surface roughness measurement. | -""- | 2 |
| Lecture 6 | Transducers to measure geometrical quantities: measuring displacements with resistive and capacitive transducers. | -""- | 2 |
| Lecture 7 | Measurement positions with inductive displacement transducers and proximity. | -""- | 2 |
| Lecture 8 | Transducers for measuring kinematic quantities: velocity measurement with incremental transducers, speeds measuring | -""- | 2 |
| Lecture 9 | Transducers for measuring kinematic quantities: velocity measurement with incremental transducers, speeds measuring | -""- | 2 |
| Lecture 10 | Transducers to measure forces: measuring tensile and compressive forces with transducers based on strain gauge stamps: measuring forces based piezoelectric pills. | -""- | 2 |
| Lecture 11 | Transducers to measure dynamic quantities: measuring accelerations with accelerometers | -""- | 2 |
| Lecture 12 | Transducers to measure vibration, noise and acoustic emission. | -""- | 2 |
| Lecture 13 | Conditioning and conversion circuits signal transducers debited, information, signals, signal sources, signal amplifiers, interface, tools, data acquisition, virtual instrumentation | -""- | 2 |
| Lecture 14 | Conditioning and conversion circuits signal transducers debited, information, signals, signal sources, signal amplifiers, interface, tools, data acquisition, virtual instrumentation | -""- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Study of sensors / transducers for measuring geometric quantities (position and displacement). | Individual study of the work stands followed by practical tests and laboratory equipment; experiment uses that method. | 2 |
| Laboratory 2 | Study of sensors / transducers for measuring geometric quantities (position and displacement). | -""- | 2 |
| Laboratory 3 | Study of sensors for measuring kinematic quantities (speed and speed). | -""- | 2 |
| Laboratory 4 | Study of sensors for measuring kinematic quantities (speed and speed). | -""- | 2 |

| | | | |
|---|---|---|---|
| Laboratory 5 | Study of proximity sensors / transducers (inductive, capacitive, based on Hall sensors). | -""- | 2 |
| Laboratory 6 | Study of proximity sensors / transducers (inductive, capacitive, based on Hall sensors). | -""- | 2 |
| Laboratory 7 | Study of proximity sensors / transducers (inductive, capacitive, based on Hall sensors). | -""- | 2 |
| Laboratory 8 | Study of sensors / transducers for measuring forces and moments. | -""- | 2 |
| Laboratory 9 | Study of sensors / transducers for measuring forces and moments. | -""- | 2 |
| Laboratory 10 | Study of sensors for temperature measurement. | -""- | 2 |
| Laboratory 11 | Study of sensors for temperature measurement. | -""- | 2 |
| Laboratory 12 | Study of sensors / transducers for measuring dynamic quantities: vibrations, noise, acoustic emission. | -""- | 2 |
| Laboratory 13 | Study of sensors / transducers for measuring dynamic quantities: vibrations, noise, acoustic emission. | -""- | 2 |
| Laboratory 14 | Synthesis of laboratory works, recoveries, submission of papers. | -""- | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

## 9. Bibliography


| | |
|---|---|
| 9.1. Recommended Bibliography | Dolga, V. Construcţia traductoarelor şi senzorilor. Centrul de multiplicare a Universităţii Politehnica, Timişoara, 1996. |
| | Iordache, P. Senzori şi traductoare electrice. Vol.2. Universitatea Transilvania, Braşov, 2000 |
| | Heler, A., Haragus, St. Traductoare pentru măsurarea mărimilor neelectrice. Universitatea Politehnica, Timişoara, 1998 |
| | Ignea , A. Măsurarea electrică a mărimilor neelectrice. Editura de Vest, Timişoara, 1996. |
| | Ionescu, G., Dobrescu, R., Droasca, B. Traductoare pentru automatizări industriale. Vol. 1 şi 2. Editura Tehnică, Bucureşti, 1996. |
| | Roşca, P. Traductoare analog-numerice pentru mărimi neelectrice. Editura Universităţii "Lucian Blaga", Sibiu, 2005. |
| | Agoston, Katalin,- Senzori si traductoare: Indrumar de laborator, 2005 |
| | Popp Ilie, *Senzori si traductoare, note decurs; lucrari de laborator - fascicole* |
| | Monica-Anca Chita - Senzori si traductoare, Ed.Matrixrom, 2003 |
| | Elena Bostan, Cosmina Georgescu - Traductoare. Culegere de probleme, Ed.Matrixrom, 2003 |
| 9.2. Additional Bibliography | Morariu, Gh. - Traductoare si senzori: Indrumar de laborator. Partea I, 2001. |
| | Purcaru D.M. – Senzori si traductoare, Vol. 1, 2, Ed. Reprograph, Craiova, 2001. |
| | Sandu M., Sandu A., Sorohan St.- Îndrumar în proiectarea senzorilor cu traductoare rezistive, Bucureşti, 2005 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| It is carried out through periodic discussions in a formal and informal setting with the representatives of the relevant companies |

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 40% | 70% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Practice | Code | FING.MEI.MCTRP.L.DO.4.P90.C-4.9 |
| 2.2. Course coordinator | Assist. PhD. eng. Preda Cosmin | | |
| 2.3. Seminar/laboratory coordinator | Assist. PhD. eng. Preda Cosmin | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 6 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | D |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 0 | 0 | 0 | 0 | 0 | **0** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 0 | 0 | 0 | 0 | 0 | **90** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 2 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 6 |
| Tutorial activities[9] | 8 |
| Exams[10] | 6 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **10** |
| **3.4. Total Hours in the Curriculum *(NOAD$_{sem}$)*** | **90** |
| **3.5. Total Hours per Semester[12] *(NOAD$_{sem}$ + NOSI$_{sem}$)*** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Subjects studied in the curriculum of the specialization |
| 4.2. Competencies | - |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | - |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Active participation in practice activities.<br>The practice consists of activities at professional companies in Sibiu, which have a field of activity related to their specialization; practical activity with the purpose of research is carried out in the specialized laboratories of the department.<br>The practice book will include:<br>- presentation of the commercial company where the practice is carried out,<br>- a daily diary regarding the activity carried out in the company,<br>- description of the activities carried out according to the theme provided by the analytical program. |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | | |
| | PC2 | | |
| | PC3 | | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | | |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The purpose of the technological practice is to develop the practical skills of the student and to fix the theoretical notions acquired in the specialized courses. Thus, training is ensured in the field of design, manufacture and operation of mechatronic systems, measurement and control equipment, sensors and transducers, specific electronic systems, biomedical, "intelligent" surveillance and control equipment, household appliances, robots and microrobots, peripheral equipment, automatic control and service, management of mechatronic systems, etc. |

| | |
|---|---|
| 7.2. Specific course objectives | It is anticipated that through the course of study of the discipline, students will be able to:<br>• Identifying the stages and technological processes for obtaining products specific to industrial engineering;<br>• Designing and organizing some phases of the technological processes;<br>• Recording and transmitting information specific to production flows in order to ensure the proper functioning of the equipment, devices, machines and installations used;<br>• Verification of quality parameters by manufacturing phases of specific products;<br>• Identifying the construction, kinematics, adjustment and programming of equipment, machines and equipment, actuation and automation systems;<br>• Knowledge of how to prepare technical documentation, organize technical services, etc. |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | | | |
| Lecture 2 | | | |
| Lecture 3 | | | |
| Lecture 4 | | | |
| Lecture 5 | | | |
| Lecture 6 | | | |
| Lecture 7 | | | |
| Lecture 8 | | | |
| Lecture 9 | | | |
| Lecture 10 | | | |
| Lecture 11 | | | |
| Lecture 12 | | | |
| Lecture 13 | | | |
| Lecture 14 | | | |
| | | **Total lecture hours:** | |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |

| | | | |
|---|---|---|---|
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | … | | |
| Laboratory 2 | … | | |
| Laboratory 3 | | | |
| Laboratory 4 | | | |
| Laboratory 5 | | | |
| Laboratory 6 | | | |
| Laboratory 7 | | | |
| Laboratory 8 | | | |
| Laboratory 9 | | | |
| Laboratory 10 | | | |
| Laboratory 11 | | | |
| Laboratory 12 | | | |
| Laboratory 13 | | | |
| Laboratory 14 | | | |
| | | **Total laboratory hours:** | |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | Technological procedures for obtaining metallic and non-metallic materials; | practical activities at professional companies/within the department's laboratories | 8 |
| Act.2 | Learning the graphic language of design; reading technical drawings: assembly, sub-assembly and execution drawings; | data collection, fieldwork, etc.; | 8 |

| | | | |
|---|---|---|---|
| | | the application of quantitative and qualitative data analysis methods | |
| Act.3 | Product quality control, geometric accuracy inspection; measuring devices and systems | -“”- | 8 |
| Act.4 | Constructive elements of mechatronics, hardware structure of mechatronic systems | -“”- | 8 |
| Act.5 | Exploitation of automatic systems, machine systems | -“”- | 8 |
| Act.6 | Programming and using computers | -“”- | 6 |
| Act.7 | Manufacturing and assembly technologies in industry, intelligent manufacturing systems | -“”- | 6 |
| Act.8 | Flexible manufacturing systems, industrial robots, CAD computer-aided design | -“”- | 6 |
| Act.9 | Measurement technique, measurement methods and principles for determining different quality characteristics | -“”- | 6 |
| Act.10 | Identification of machine mechanisms and organs; | -“”- | 6 |
| Act.11 | Processes, machines and technological equipment of mechanical processing | -“”- | 6 |
| Act.12 | Processes, machines and technological equipment for processing plastic deformation | -“”- | 6 |
| Act.13 | Actuators, electromechanical and hydro-pneumatic equipment and installations, electronic systems in production systems | -“”- | 4 |
| Act.14 | Presentation and support of the practice book | -“”- | 4 |
| | | **Total other practical activities hours:** | 90 |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Maties, V. Mecatronica. Editura Dacia, Cluj-Napoca, 1998. |
| | Maties, V., Mandru, D., Balan, R., Tatar, O., Rusu, C. Tehnologie si educatie mecatronica, Editura TODESCO, Cluj-Napoca, 2001. |
| | Barsan, I. Acţionări hidraulice şi pneumatice, Editura ULBS. |
| | Bogdan, L., Dorin, A. Acţionarea electrică a maşinilor unelte şi roboţilor industriali, Editura BREN, Bucureşti, 1998. |
| | Breaz, R., Bogdan, L. Automatizări în industrie, Editura ULBS 2003. |
| | Taniguchi N. Nanotehnologie, Sisteme de procesare integrata pentru produse ultrafine si de ultraprecizie. Editura tehnica Bucuresti, 2000. |
| | McCarthy A. - Methods of Analysis and Detection – Cambridge, 1997 |
| | Handraluca, V., s.a. – Roboti, Ed. Dacia, Cluj-Napoca, 1996. |
| | Munteanu, O., s.a. – Bazele roboticii. Roboti industriali, Ed. Lux Libris, Brasov, 1996. |
| | Staretu, I. – Sisteme de prehensiune, Ed. Lux Libris, Brasov, 1996 |
| | Telea. D., Ceusianu, N. – Roboti, Ed. Dacia, Cluj-Napoca, 2002. |
| | Barbu, Şt. – Elemente de mecanică fină, Editura Universităţii „Lucian Blaga”, Sibiu, 2000 |
| | Barbu, Şt. – Ingineria sistemelor mecanice. Editura Universităţii „Lucian Blaga” Sibiu, 2005. |
| 9.2. Additional Bibliography | Fetche, V., Maşini unelte cu comandă numerică, Editura ULB Sibiu 2005 |
| | Oprean, C., Kifor, C. V., Managementul Calităţii, Sibiu, Editura Universităţii Lucian Blaga din Sibiu, ISBN 973 651 310 6, 2002. |
| | Dumitraş, C., ş.a. Ingineria controlului dimensional şi geometric în fabricarea maşinilor. Bucureşti, Editura Tehnică, 1997. |
| | Simion, Carmen, Toleranţe geometrice. Principii şi metode de verificare. Editura Universităţii "Lucian Blaga" din Sibiu, 2006. |

| | |
|---|---|
| | Popescu, I., Duşe, D.M. Tehnologii moderne de fabricare a maşinilor, Editura Universităţii din Sibiu, 2003 |
| | Zetu D. ş.a. – Sisteme flexibile de fabricaţie. Ed. Junimea, Iaşi, 1998 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through periodic discussions in a formal and informal setting with representatives of relevant companies.
The design and implementation of activities, research projects with the aim of applying the skills acquired following the study of the discipline.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 100% (minimum 5) | The final evaluation will include: oral examination of knowledge, based on the practice notebook, during the colloquium that takes place on the last day of practice. |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 0% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 0% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | 50% minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_2_|_8_| / |_1_|_0_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Assist. PhD. eng. COSMIN Preda | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **"Lucian Blaga " University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipments |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | License |
| 1.6. Programme of study/qualification | Mechatronics/Engineer |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| **2.1.** Name of course | Control systems in robotics | | | Cod | |
| **2.2.** Course coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | | | |
| **2.3.** Seminar/laboratory coordinator | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | | | | |
| **2.4.** Year of study[2] | IV | **2.5.** Semester[3] | 7 | **2.6.** Evaluation form[4] | C |
| **2.7.** Course type[5] | O | **2.8.** The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| **3.1.** Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| **3.2.** Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Nr. ore** |
|---|---|
| Learning by using course materials, references and personal notes | 15 |
| Additional learning by using library facilities, electronic databases and on-site information | 15 |
| Preparing seminars / laboratories, homework, portfolios and essays | 14 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| **4.1.** Courses that must be successfully completed first<br>**4.2.** (from the curriculum)[14] | Fundamentals of robotics, Programming of microcontrollers |
| **4.3.** Competencies | Competente de operare pe calculator (minimal: Office, browser internet). |

**5. Conditions** (where applicable)

| | |
|---|---|
| **5.1.** For course/lectures[15] | • |
| **5.2.** For practical activities<br>**5.3.** (lab/sem/pr/app) [16] | • |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | PC1 | Ability to design, implement, and optimize control algorithms (e.g., PID, adaptive, and model predictive control) for precise and efficient robotic movement, ensuring stability and accuracy in dynamic environments. | |
| | PC2 | Proficiency in integrating various sensors (e.g., LIDAR, IMU, encoders) and actuators with control systems to achieve real-time feedback and adjust robotic behavior, ensuring accurate positioning, navigation, and task execution. | |
| | PC3 | Designs automation components; | |
| | PC4 | Calculates the necessary materials for building equipment; | |
| | PC5 | Develops testing procedures for mechatronic products, systems, and components; | |
| | PC6 | Describes the electric drive system and analyzes test data; | |
| **6.2. Transversal competencies** | TC1 | Analyzes test data; | |
| | TC2 | Manages personal professional development; | |
| | TC3 | Synthesizes information. | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| **7.1.** Main course objective | • Acquiring knowledge on achieving control systems of robots, especially industrial robots (RI) |
| **7.2.** Specific course objectives | • Acquiring concepts for achieving the robot model;<br>• Gaining knowledge related to robot motion planning;<br>• Understand techniques for achieving management scheme and algorithm using template available robots and programming activities.<br>• Formation of creative thinking and teamwork. |

**8. Content**

| **8.1. Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to mechatronics. Defining the parameters positioning. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 2 | Homogeneous representation of objects. Homogeneous transformations. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 3 | Determination direct geometric model (open chain structure). Direct geometric model for closed chain structure. | Classical lecture, assisted by use of modern design images | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Inverse geometric model. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 5 | Homogeneous differential transformer. Jacobi matrix. Examples. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 6 | The dynamic drive subsystem. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 7 | The dynamic model for handling structure. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 8 | Motion trajectory point by point. Continuous motion path. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 9 | Specifying movement. Generalized coordinate trajectory planning: planning a path between two specified points and planning a path with many points mentioned. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 10 | Coordinate operational trajectory planning | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 11 | The management of industrial robots using state space. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 12 | Driving numerical RI. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 13 | RI leadership based on kinematic model.. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 14 | RI adaptive management | Classical lecture, assisted by use of modern design images | 2 |
| | | **Total ore curs:** | **28** |

| **8.2. Practical activities (8.2.a. Seminar22/ 8.2.b. Laboratory23/ 8.2.c. Project24)** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| **Act.1** | Safety. Presentation of the laboratory. | experimentul, metodele euristice | 2 |
| **Act.2** | Homogeneous geometric transformations. | experimentul, metodele euristice | 2 |
| **Act.3** | Direct geometric model (MGD). Inverse geometric model (MGI) RI . | experimentul, metodele euristice | 2 |
| **Act.4** | Management control systems in conventional industrial robots. | experimentul, metodele euristice | 2 |
| **Act.5** | Driving with a computer manipulator with two degrees of freedom. | experimentul, metodele euristice | 2 |
| **Act.6** | Driving with a computer manipulator with three degrees of freedom. | experimentul, metodele euristice | 2 |
| **Act.7** | Driving with a computer manipulator with four degrees of freedom. | experimentul, metodele euristice | 2 |
| **Act.8** | Driving with a computer manipulator with five degrees of freedom. | experimentul, metodele euristice | 2 |
| **Act.9** | Driving with a computer manipulator with six degrees of freedom. | experimentul, metodele euristice | 2 |
| **Act.10** | Navigation algorithms. | experimentul, metodele euristice | 2 |
| **Act.11** | Autoacordabil PID algorithm leading to an axis of an industrial robot | experimentul, metodele euristice | 2 |
| **Act.12** | Presentation of specific programs for robot control systems | experimentul, metodele euristice | 2 |
| **Act.13** | Presentation of specific programs for robot control systems | experimentul, metodele euristice | 2 |

| | | | |
|---|---|---|---|
| **Act.14** | Final evaluation | experimentul, metodele euristice | 2 |
| | | **Total seminar/laboratory hours:** | |

## 9. Bibliography

| | |
|---|---|
| **9.1** Recommended Bibliography | Nitulescu M., Sisteme de conducere în robotică. Note De Prezentare, Editura Universitaria, ISBN: 978-606-14-1558-8, pg. 210, 2019 |
| | Moise, A., Sisteme de conducere a roboGilor, Ed. Universitatii Petrol-Gaze, Ploiesti, 2006. |
| | Ion, D., Diatcu, E., Roboti mobili si vehicule ghidate automat, Editura Victor, 2003 |
| | Ivanescu, M., s.a. Sisteme neconventionale pentru conducerea roboților, Ed. Universitaria, Craiova, 2002 |
| | Gh.Lazea,E.Lupu,P.Dobra –Sisteme de conducere a robotilor si fabricatie integrata Ed.Mediamira,Cluj-N.,1997 |
| | Pănescu D., Sisteme de conducere a roboţilor industriali - Modelare şi planificarea traiectoriei, Rotaprint Universitatea Tehnică "Gh. Asachi" Iaşi, 1996. |
| | Voicu M., Lazăr C., Sisteme de conducere a roboţilor industriali, vol. III, Rotaprint I. P. Iaşi, 1987. |
| **9.2** Referințe bibliografice suplimentare | Borangiu Th., Hossu A., Sisteme educaţionale în robotică, Edit. Tehnică, Bucureşti, 1991. |
| | Davidoviciu A., Drăgănoiu Gh., Moangă A., Modelarea, simularea şi comanda manipulatoarelor şi roboţilor industriali, Edit. Tehnică, 1986. |
| | Fu K. S., Gonzalez R. C., Lee C. S. G., Robotics, Mc Graw-Hill, 1987. |
| | Ivănescu M., Roboţi industriali, Edit. Universitaria, Craiova, 1994. |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal setting with the representatives of the profile companies

## 10 Evaluare

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 20% | 70% (minimum 5) | Write |
| | | Homework: | 10% | | |
| | | Other activities[28]: | 10% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |

| 11.5 Standard minim de performanță[29] | Nota 5 |
|---|---|

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs***

Filling Date: 08.09.2024

Department Acceptance Date: 13.09.2024

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | PhD. Lecturer Eng. Iosif Adrian MAROȘAN | |
| **Study Program Coordinator** | s.l. dr. ing. Claudia-Emilia GÎRJOB | |
| **Head of Department** | s.l. dr. ing. Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Flexible manufacturing systems 1 | Code | MCTEN.702.SO |
| 2.2. Course coordinator | Assoc. prof. dr. ing. Mihai CRENGANIȘ | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. dr. ing. Alexandru BÂRSAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | IV | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 28 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 3 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Fundamentals of robotics, Microcontroller programming, Sensors and sensing systems, Fundamentals of mechatronic systems, Electronics, Fundamentals of automatic systems |
| 4.2. Competencies | Knowledge of Industrial Drives, Fundamentals of Automatic Systems, Fundamentals of Mechatronic Systems, Computer Aided Design |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and applied presentations, Reading recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Preparation and defense of planned work. Active participation, Reading recommended bibliography |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | simulates mechatronic design concepts | 0.8 |
| | PC2 | develop mechatronic test procedures | 0.4 |
| | PC3 | describes the electrical drive system | 0.4 |
| | PC4 | tests mechatronic units | 0.4 |
| | PC5 | designs prototypes | 0.4 |
| | PC6 | designs automation components | 0.4 |
| **6.2. Transversal competencies** | TC1 | synthesizes information | 0.4 |
| | TC2 | finds solutions to problems | 0.4 |
| | TC3 | thinks abstractly | 0.4 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Developing students' skills in the design, implementation and optimization of flexible manufacturing systems (FMS), with a special focus on the effective integration of industrial robots and automation technologies |
| 7.2. Specific course objectives | Understanding the fundamental concepts of flexible manufacturing systems<br>Classifying and analyzing the types of robots used in FFFS<br>Applying kinematics and dynamics principles to industrial robots<br>Setting up and operating automated handling and transfer systems<br>Integration of sensors and sensing systems in production processes<br>Implementing robot control and monitoring techniques in the production line<br>Optimizing production flow through performance analysis and evaluation techniques<br>Application of IoT and AI technologies to improve the flexibility and autonomy of SFF<br>Realizing a full simulation project of a flexible manufacturing system |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Flexible Manufacturing Systems (FMS), Getting to automation systems, Sequential automation | The classic lecture (synthetic presentation, explanations, demonstration through diagrams, graphs) supported by | 2 |

| | | | |
|---|---|---|---|
| | | the use of image projection tools / problem-based learning, learning through discovery, experiment, and case study. | |
| Lecture 2 | Classification and Role of Flexible Systems, Automation Systems Concepts, Flexible Automation, Flexibility-Automation Correlation | - ” - | 2 |
| Lecture 3 | Main components of FFF, Specific constructive elements of numerical control machines (drive, command, control) | - ” - | 2 |
| Lecture 4 | Specific constructive elements of industrial robots (drive, command, control) | - ” - | 2 |
| Lecture 5 | Integration of Robots in SFF | - ” - | 2 |
| Lecture 6 | SFF specific robotic structures, RI specific kinematic schemes | - ” - | 2 |
| Lecture 7 | Integration of Serial Robots in FMS | - ” - | 2 |
| Lecture 8 | Parallel Robots and Their Use in Flexible Manufacturing | - ” - | 2 |
| Lecture 9 | VGA, Mobile Robots: Navigation and Applications | - ” - | 2 |
| Lecture 10 | Integration of Automation Systems in SFF | - ” - | 2 |
| Lecture 11 | Solving the direct kinematic problem of IR with multiple degrees of freedom | - ” - | 2 |
| Lecture 12 | Motion and Force Control in Industrial Robots | - ” - | 2 |
| Lecture 13 | Trajectory Planning for Flexible Systems | - ” - | 2 |
| Lecture 14 | Advanced Kinematics for Serial and Parallel Robots | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Work protection instructions, laboratory and thematic presentation, automation concept | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Sequential automation of manufacturing systems | - ” - | 2 |
| Laboratory 3 | Flexible automation of manufacturing systems | - ” - | 2 |
| Laboratory 4 | RI/M handling/transfer. Structure, kinematics, kinematics, actuation, Analysis and Classification of Robots in the Laboratory | - ” - | 2 |
| Laboratory 5 | Study of a manipulator used in inter-operational transfer | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 6 | Implementation of industrial robots, Inter-operational transfer subsystems, Simulation of an ABB robot in a production cell | - ” - | 2 |
| Laboratory 7 | Automation of a Production Line | - ” - | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Telea, D., Roboti, Ed. Dacia Cluj-Napoca, 2001 |
| | Telea, D., Mașini, echipamente si strategii in SFP, Ed. Univ.L Blaga, 2009 |
| | Telea, D., Bazele roboticii Ed.Univ.L Blaga, Sibiu, 2010 |
| | Telea, D. & Crenganis M. Roboti industriali. Ed.Univ.L Blaga, Sibiu, 2016 |
| | Chicea A. & Crenganis M. Bazele sistemelor mecatronice, Ed.Univ.L Blaga, Sibiu, 2017 |
| | Crenganis M. & Chicea A. Mecatronica roboților si manipulatoarelor industriale Ed.Univ.L Blaga, Sibiu, 2018 |
| | Giurgiutiu V., Lyshevski S.E., *Micromechatronics*, CRC Press, Inc.2004, ISBN: 0-8493-1593 |
| | Mogan G.L., Proiectarea constructivă a sistemelor mecanice ale produselor mecatronice, Ed. Univ. Transilvania, Braşov, 2003 |
| | Taraboanta F. - Mecatronica generala, Ed. Gh. Asachi, Iasi, 2002 |
| | Bishop H. Robert, *The Mechatronics Handbook*, CRC Press, London-New York-Washington, 2002 |
| | |
| | |
| | |
| 9.2. Additional Bibliography | Crenganis M. & Chicea A. Redundanta roboților seriali si industriali Ed.Univ.L Blaga, Sibiu, 2020 |
| | Fu K. S., Gonzalez R. C., Lee C. S. G., Robotics, Mc Graw-Hill, 1987. |
| | Ivănescu M., Roboţi industriali, Edit. Universitaria, Craiova, 1994. |
| | |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through periodic discussions in formal and informal settings with representatives of specialized companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired | Tests during the semester[27]: | 30% | 70% (minimum 5) | Oral |
| | | Homework: | 0% | | |

| | | | | | |
|---|---|---|---|---|---|
| | (quantity, correctness, accuracy) | Other activities[28]: | 0% | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | Grade 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. prof. PhD Mihai Crenganis | |
| **Study Program Coordinator** | Assoc. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Manufacturing technologies and micro/nanotechnologies | | | Code | FING.MEI.MCTEN.L.SO.7.2011.E-5.3 | |
| 2.2. Course coordinator | Lect. PhD. Eng. Andrei Horia BRANESCU | | | | | |
| 2.3. Seminar/laboratory coordinator | Lect. PhD. Eng. Andrei Horia BRANESCU | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 1 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 14 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 36 |
| Additional learning by using library facilities, electronic databases and on-site information | 20 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 6 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **69** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Technical drawing, Material science, Dimension Tolerances, Metalworking machines and manufacturing |
| 4.2. Competencies | Graphics general technical knowledge, quality and precision of products |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Properly equipped classroom |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Laboratory room which allows individual work, properly equipped to carry out the practical work. Absences will be accepted by the amount provided by the regulations, with mandatory recovery before the exam. |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | | |
| | PC2 | | |
| | PC3 | | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | | |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge regarding the technological processes design and the transformation of the raw material into products. |
| 7.2. Specific course objectives | • Developing technological processes design capabilities<br>• Comprehension of the manufacturing possibilities, of any geometrical shape, at a specific precision<br>• Understanding of the discipline-specific terms<br>• Strengthening and capitalizing the capacity of cooperation between the mechanical and economic field through product manufacturing technologies design<br>• Enhancing a positive attitude towards technological progress and its economic requirements. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | General notions regarding manufacturing | Classic lecture (synthetic presentation, explanations, demonstrations by diagrams, graphics) assisted by the use of means of image projections / | 2 |

| | | | |
|---|---|---|---|
| | | problematization, learning by discovery, experiments and case studies. | |
| Lecture 2 | Surface machining by turning and milling | - ” - | 2 |
| Lecture 3 | Surface machining by drilling, planning and grinding | - ” - | 2 |
| Lecture 4 | Surface machining by drilling, planning and grinding | - ” - | 2 |
| Lecture 5 | The technological system notion. Production process and technological process | - ” - | 2 |
| Lecture 6 | Technological process structure. Production types in the automotive industry | - ” - | 2 |
| Lecture 7 | Construction technologicality of raw parts and products. Measures for achieving a high degree of technologicality of raw parts and products. | - ” - | 2 |
| Lecture 8 | Initial data required for designing technological processes. Technological documentation prepared for the elaboration of technological processes. Notions regarding the symbolization of the orientation and fixing of the raw parts and their presentation on the operations plans. | - ” - | 2 |
| Lecture 9 | Technological and geometrical constraints while setting up the order of the manufacturing processes. | - ” - | 2 |
| Lecture 10 | Principles regarding the optimal sequence of the operations in the technological process. | - ” - | 2 |
| Lecture 11 | Establishment of the technological system elements. Establishment of the machine. Establishment of the devices, manufacturing and measuring tools. | - ” - | 2 |
| Lecture 12 | Establishment of the intermediate and total cutting depth. | - ” - | 2 |
| Lecture 13 | Calculating the optimal feeds and speeds. Establishing the technical time-norm. | - ” - | 2 |
| Lecture 14 | Typified technologies for products within the shafts and nuts families. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Presentation of the laboratory work. Work safety training. Materials for cutting tools. | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Manufacturing methods. Cutting tools used in the laboratory. | - ” - | 2 |
| Laboratory 3 | Elementary notions regarding the cutting tool geometry. | - ” - | 2 |
| Laboratory 4 | Presentation of the CNC lathe – EMCO COMPACT 5 CNC: Controls and manual operation. | - ” - | 2 |
| Laboratory 5 | Machining using the CNC lathe – EMCO COMPACT 5 CNC: Controls and manual operation. | - ” - | 2 |
| Laboratory 6 | Programming of the CNC lathe – EMCO COMPACT 5 CNC | - ” - | 2 |
| Laboratory 7 | Influence of several technological factors, regarding the surface roughness of parts machined by turning. | - ” - | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | Receiving the assignment.<br>Product study based on the execution drawing, in order to assess its technologicality. | Theoretical study / Practical applications | 2 |
| Project 2 | Analysis of the imposed technical conditions. Analysis of the manufacturing possibilities. Data regarding the raw part. | - ” - | 2 |
| Project 3 | Designing the technological process, the structure of the technological process and the operation sequence. | - ” - | 2 |
| Project 4 | Designing the technological process, technological system elements establishment and operation sketches. | - ” - | 2 |
| Project 5 | Designing the technological process, calculus of the cutting depths and of the feeds and speeds for 4 different operations. | - ” - | 2 |
| Project 6 | Technical-economical calculus for process optimization. | - ” - | 2 |
| Project 7 | Technical drawing of the product and raw part. Operation plans for 2 operations, approached through analytical calculus. | - ” - | 2 |
| | | **Total project hours:** | 14 |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Brăgaru, A., Picoş, C., Ivan, N., *Optimizarea proceselor şi echipamentelor tehnologice,* E.D.P., Bucureşti, 1996. |
| | Ciocirdia , C-tin, ş.a., *Bazele elaborării proceselor tehnologice in construcţia de maşini,* EDP, Bucureşti 1983. |
| | Drăghici, Gh., *Ingineria integrată a produselor*, Ed. Eurobit, Timişoara, 1999. |
| | Drăghici, Gh., *Tehnologia construcţiei de maşini*, Bucureşti, E.D.P., 1992. |
| | Duşe, D.M. şi Bologa, O., *Tehnologii de prelucrare tipizate*, E. Universităţii Sibiu, 1995. |
| | Duşe, D.M. şi Dârzu, V., *Tehnologii de prelucrare. Vol.I. Bazele teoretice ale tehnologiilor de prelucrare*, Editura Universităţii din Sibiu, 2001. |
| | Duse, D. M., Bondrea, I. *Fabricaţia integrată de calculator CIM a transimisiilor cardanice,* Editura Universităţii din Sibiu, 2003. |
| | Duse, D. M., Popescu, I., *Tehnologii moderne de fabricare a maşinilor*, vol 1 si 2, Editura Universităţii din Sibiu,2003, 2007. |

| | |
|---|---|
| | Picoş, C., Pruteanu, O., Bohosievici C. ş.a., *Proiectarea tehnologiilor de prelucrare mecanică prin aşchiere; manual de proiectare in două volume*, Vol 2, Ed Universitas, 1992. |
| | Stetiu Gr., Darzu V., Duse D.M., Radu V., *Tehnologia construcţiilor de maşini,* Indrumar de laborator, Editura Universităţii din Sibiu, 1991. |
| | Brăgaru, A., Picoş, C., Ivan, N., *Optimizarea proceselor şi echipamentelor tehnologice,* E.D.P., Bucureşti, 1996. |
| | Brăgaru, A., Picoş, C., Ivan, N., *Optimizarea proceselor şi echipamentelor tehnologice,* E.D.P., Bucureşti, 1996. |
| 9.2. Additional Bibliography | 1.Cofaru, N., Prelucrări pe maşini unelte cu comandă numerică, Editura Universităţii "Lucian Blaga" din Sibiu, 2002 |
| | 2.Cofaru, N., Proiectarea asistată a tehnologiilor, Editura Universităţii "Lucian Blaga" din Sibiu, 2002 |
| | 3.Cofaru, N., Breaz, R., Programarea şi exploatarea maşinilor de frezat cu comanda numerică, Editura Universităţii "Lucian Blaga" din Sibiu, 2006 |
| | 4.Morar, L., Programarea sistemelor numerice CNC, UTPRES, Cluj Napoca, 2006 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 30% | 70% (minimum 5) | |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 70% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 25% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 5% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_2_|_7_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_0_|_2_| / |_1_|_0_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lect. PhD. Eng. Andrei Horia BRANESCU | |
| **Study Program Coordinator** | Assoc. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS (english language) |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| 2.1. Name of course | Computer-aided engineering mechatronic systems | | Code | MCTEN.704.SO | |
| 2.2. Course coordinator | Associate professor PhD. Cristina Maria BIRIȘ | | | | |
| 2.3. Seminar/laboratory coordinator | Assistant PhD. Dan Mihai RUSU | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 28 |
| Additional learning by using library facilities, electronic databases and on-site information | 21 |
| Preparing seminars / laboratories, homework, portfolios and essays | 20 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours**[11] ***(NOSI$_{sem}$)*** | **69** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester**[12] **(*NOAD$_{sem}$* + *NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits**[13] | **5** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer-aided graphics, mechanisms and machine parts, computer-aided design |
| 4.2. Competencies | Computer skills (minimum Office, Internet browser) |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video-projector, specific didactic materials, active participation, lecturing the course |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Computing, specific software package (CATIA), writing and presenting planned papers, active participation |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | use CAD software | 2 |
| | PC2 | concepe planuri tehnice. | 1 |
| | PC3 | concepe designul produsului | 1 |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | gândește în mod abstract | 1 |
| | TC2 | | |
| | TC3 | | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowledge of and understanding concepts, theories and basic methods of computer-aided design |
| 7.2. Specific course objectives | It is anticipated that by the end of the course, the students will be able to:<br>- use the methods and techniques of computer-aided design;<br>- computer-aided design three-dimensional models of medium and high complexity;<br>- respect personal characteristics. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Volumetric 3D modelling of mechatronic systems: making assemblies (I) | Lecturing (synthetical presentation, explanations, demonstrations by using schemes, graphics) supported by using modern methods of image projection. | 2 |
| Lecture 2 | Volumetric 3D modelling of mechatronic systems: making assemblies (II) | - ” - | 2 |
| Lecture 3 | Parametrizing 3D models of mechatronic systems | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Methods and techniques used in hybrid modelling: generating wireframes | - ” - | 2 |
| Lecture 5 | Methods and techniques used in hybrid modelling: generating surfaces (I) | - ” - | 2 |
| Lecture 6 | Methods and techniques used in hybrid modelling: generating surfaces (II) | - ” - | 2 |
| Lecture 7 | Methods and techniques used in hybrid modelling: generating surfaces (III) | - ” - | 2 |
| Lecture 8 | Methods and techniques used in hybrid modelling: generating surfaces (IV) | - ” - | 2 |
| Lecture 9 | Methods and techniques used in hybrid modelling: generating surfaces (V) | - ” - | 2 |
| Lecture 10 | Computer-aided design using CATIA: general concepts of simulating the cinematic of mechanisms | - ” - | 2 |
| Lecture 11 | Computer-aided design using CATIA: importing assemblies and analysis of component mechanisms | - ” - | 2 |
| Lecture 12 | Computer-aided design using CATIA: generating cinematic couplings of mechanisms | - ” - | 2 |
| Lecture 13 | Computer-aided design using CATIA: defining the laws of motion | - ” - | 2 |
| Lecture 14 | Computer-aided design using CATIA: cinematic simulation of mechanisms and interpreting the results | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Designing 3D assemblies using CATIA v5 | Heuristic methods | 2 |
| Laboratory 2 | Designing 3D hybrid parts using CATIA v5 (I) | - ” - | 2 |
| Laboratory 3 | Designing 3D hybrid parts using CATIA v5 (II) | - ” - | 2 |
| Laboratory 4 | Designing 3D hybrid parts using CATIA v5 (III) | - ” - | 2 |
| Laboratory 5 | Designing 3D hybrid parts using CATIA v5 (IV) | - ” - | 2 |
| Laboratory 6 | Designing 3D hybrid parts using CATIA v5 (V) | - ” - | 2 |
| Laboratory 7 | Designing 3D hybrid parts using CATIA v5 (VI) | - ” - | 2 |
| Laboratory 8 | Designing 3D hybrid parts using CATIA v5 (VII) | - ” - | 2 |
| Laboratory 9 | Designing 3D hybrid parts using CATIA v5 (VIII) | - ” - | 2 |
| Laboratory 10 | Designing 3D hybrid parts using CATIA v5 (IX) | - ” - | 2 |
| Laboratory 11 | Designing 3D hybrid parts using CATIA v5 (X) | - ” - | 2 |
| Laboratory 12 | Cinematic simulation for various component mechanisms of mechatronic systems (I) | - ” - | 2 |
| Laboratory 13 | Cinematic simulation for various component mechanisms of mechatronic systems (II) | - ” - | 2 |
| Laboratory 14 | Cinematic simulation for various component mechanisms of mechatronic systems (III) | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Ghionea, I.G., Tarba C., Cukovic S., CATIA v5 Advanced Parametric and Hybrid 3D Design, Ed. CRC Press, Taylor & Francis, Florida, USA, 2021 |
| | Ghionea, I.G., CATIA v5. Aplicaţii de proiectare parametrică şi programare, Ed. Printech, București, 2021 |
| | Ghionea, I.G., Proiectarea asistată în CATIA v5. Elemente teoretice şi aplicaţii, Editura Bren, Bucureşti, 2007. |
| | Ispas, C., ş.a., Maşini-unelte, Elemente de structură, Editura Tehnică, Bucureşti,1997. |
| | Racz, G., Proiectarea asistată de calculator utilizând CATIA v5, note de curs, 2021. |
| | Racz, G., Cojocaru, S., Proiectarea maşinilor şi utilajelor. Teoria. , Editura Universităţii „Lucian Blaga" din Sibiu, 2003. |
| | Racz, G., Proiectarea maşinilor şi utilajelor, Editura Universităţii „Lucian Blaga" din Sibiu, 2007. |
| | Telea, D., ş.a., Maşini, utilaje şi strategii în sisteme flexibile de producţie, Editura Dacia, Cluj – Napoca, 2001. |
| 9.2. Additional Bibliography | Catia v5, Dassault Systemes, 2017-2021 |
| | Catia V5 for designers, 13th Edition, ed. Cadcim Technologies, 2016 |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in formal and informal meetings with the representatives of profile compnies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 50% (minimum 5) | Oral exam |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 50% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Associate professor PhD Cristina Maria BIRIȘ | |
| **Study Program Coordinator** | Associate professor PhD Mihai CRENGANIȘ | |
| **Head of Department** | Associate professor PhD Claudia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.\,credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Maintenance of mechatronic systems | | | | Code | MCTEN.705.SA |
| 2.2. Course coordinator | Lecturer PhD. Mihai-Octavian POPP | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Mihai-Octavian POPP | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 26 |
| Additional learning by using library facilities, electronic databases and on-site information | 14 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Fundamentals of mechatronic systems, applied mechatronic systems, machines and processing systems |
| 4.2. Competencies | Mechanical and electrical maintenance and repair, computer operating skills |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation; observe how and duration of the course; will not be tolerated discussions between students and phone calls during class; reading training materials and recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Active participation; Develop and support the planned work. Comply with the order and duration of development of the laboratory; agreement to perform practical work under the supervision of the teacher and analyst |

**6. Specific competencies acquired[17]**

| | | Number of credits assigned to the discipline[18] | 4 | Credits distribution by competencies[19] |
|---|---|---|---|---|
| **6.1. Professional competencies** | PC1 | analyse test data | | 0.5 |
| | PC2 | conduct quality control analysis | | 0.5 |
| | PC3 | develop mechatronic test procedures | | 0.5 |
| | PC4 | execute analytical mathematical calculations | | 0.5 |
| | PC5 | perform data analysis | | 0.5 |
| | PC6 | test mechatronic units | | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesise information | | 0.5 |
| | TC2 | create solutions to problems | | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowing all the activities and information support the management of all the categories of technical and economic information needed for optimum deployment of maintenance activity. Knowledge of the concepts of reliability, maintainability, availability and maintenance, from the theoretical and practical. Assimilation news in computer aided maintenance |
| 7.2. Specific course objectives | Knowledge of the disciplines taught in the preparatory work aimed mechatronic engineer for those systems that realize knowledge management "total" equipment by establishing a unique and comprehensive database for optimal operation of machinery, tools and equipment. Use the full capacity of mechatronic system control, together with continuous monitoring of it. Ability to perform technical diagnosis of machinery and equipment and make repairs and restored to service. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | General notions on optimal exploitation of mechatronics systems. | Lecture: problem solving, exposure synthetic explanations, demonstration by charts, graphs. Method: learning through discovery and case study. | 2 |
| Lecture 2 | General problems concerning technical diagnosis equipment. | -””- | 2 |
| Lecture 3 | Statistics applied as a tool for reliability and maintenance systems. | -””- | 2 |
| Lecture 4 | Basics of reliability, effectiveness indicators. | -””- | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Maintenance of mechatronic systems: definition, scope and responsibility. | -””- | 2 |
| Lecture 6 | Maintenance systems, levels of complexity of maintenance. | -””- | 2 |
| Lecture 7 | Maintenance systems, levels of complexity of maintenance. | -””- | 2 |
| Lecture 8 | Total productive maintenance, optimization algorithm based on complex programs. | -””- | 2 |
| Lecture 9 | Total productive maintenance, optimization algorithm based on complex programs. | -””- | 2 |
| Lecture 10 | Methods of management of maintenance activities. | -””- | 2 |
| Lecture 11 | Methods of management of maintenance activities. | -””- | 2 |
| Lecture 12 | Computer systems that support of quality of maintenance. | -””- | 2 |
| Lecture 13 | Maintenance applications of mechatronic systems: intelligent robotics, biomedical mechatronic, "smart" office products. | -””- | 2 |
| Lecture 14 | Maintenance applications of mechatronic systems: intelligent robotics, biomedical mechatronic, "smart" office products. | -””- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Removing defects, diagnosis technique for universal machines and CNC machines of laboratory. | Individual study of the work stands followed by practical tests and laboratory equipment; experiment used as method. | 2 |
| Laboratory 2 | Specific documentation preparation for maintenance and repair mechatronics systems. | -“”- | 2 |
| Laboratory 3 | Applications and problems within reliability calculations of mechatronics system. | -“”- | 2 |
| Laboratory 4 | Operation of a mechatronic system analysis. | -“”- | 2 |
| Laboratory 5 | Maintenance of hydraulic and pneumatic devices and systems. | -“”- | 2 |
| Laboratory 6 | Maintenance of flexible manufacturing systems and robots. | -“”- | 2 |
| Laboratory 7 | Application for assisted optimization of maintenance management activities. | -“”- | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Fleser T. - Mentenanta utilajelor tehnologice, Ed. OID. ICM, Bucuresti, 1998. |
| | Popp, I. – Exploatarea, reglarea şi întreţinerea mşinilor unelte, Ed. ULB, Sibiu, 2003 |
| | Popp, I. – Mentenanta sistemelor tehnice – note de curs |
| | Popp I. – Indrumar de lucrari de laborator de mentenanta – fascicola |
| | Deneş, C. - Fiabilitatea şi mentenabilitatea sistemelor tehnice. Sibiu, Editura „Alma Mater", 2003 |
| | Marc, Gabriel - Managementul activitatii de mentenanta, Ed. Facla, Timisoara, 1999 |
| | Teodorescu N., Mentenanta generala in domeniul ingineriei mecanice, Ed. Agir, Bucuresti, 2008 |
| | Baron, T, s.a., - Calitate si fiabilitate, vol. I si II, Ed. Tehnica Bucuresti, 1988. |
| | Deliu, M.: Fiabilitatea maşinilor-unelte, Editura Universităţii Transilvania din Braşov, 2002 |
| 9.2. Additional Bibliography | Martinescu, I., Popescu, I.: Analiza fiabilităţii şi securităţii sistemelor, Editura Universităţii Transilvania din Braşov, 2002 |
| | Mărăscu-Klein, V., Toma, V.: Managementul mentenanţei, Editura Universităţii Transilvania din Braşov, 2007. |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 70% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Reliability and maintenance | | | | Code | MCTEN.706.SA |
| 2.2. Course coordinator | Lecturer PhD. Mihai-Octavian POPP | | | | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Mihai-Octavian POPP | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 7 | 2.6. Evaluation form[4] | | E |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 26 |
| Additional learning by using library facilities, electronic databases and on-site information | 14 |
| Preparing seminars / laboratories, homework, portfolios and essays | 18 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **58** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | The basics of mechatronic systems, the actuation and automation of mechatronic systems |
| 4.2. Competencies | Knowledge of the construction and operation of mechatronic systems, drives and automation, probability theory and mathematical statistics. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and application presentations; to respect the manner and duration of the course. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned works, active participation; to respect the manner and duration of the laboratory. |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | | 4 |
| **6.1. Professional competencies** | PC1 | Analyse test data | 0.5 |
| | PC2 | Conduct quality control analysis | 0.5 |
| | PC3 | Develop mechatronic test procedures | 0.5 |
| | PC4 | Execute analytical mathematical calculations | 0.5 |
| | PC5 | Perform data analysis | 0.5 |
| | PC6 | Test mechatronic units | 0.5 |
| **6.2. Transversal competencies** | TC1 | Synthesise information | 0.5 |
| | TC2 | Create solutions to problems | 0.5 |

Credits distribution by competencies[19]

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Knowing all the activities and information support the management of all the categories of technical and economic information needed for optimum deployment of maintenance activity. Knowledge of the concepts of reliability, maintainability, availability and maintenance, from the theoretical and practical. Assimilation news in maintenance field. |
| 7.2. Specific course objectives | The knowledge taught in this discipline aims to prepare the future mechatronic engineer for the optimal exploitation of mechatronic systems and equipment. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Operation of mechatronic systems; The concept of quality, reliability; the quality-reliability-maintainability relationship. | Lecture: problem solving, exposure synthetic explanations, demonstration by charts, graphs. Method: learning through discovery and case study. | 2 |
| Lecture 2 | Product reliability; reliability indicators and parameters, reliability function. | -””- | 2 |
| Lecture 3 | Product reliability; reliability indicators and parameters, reliability function. | -””- | 2 |
| Lecture 4 | Determining the reliability of the products; reliability tests. | -””- | 2 |
| Lecture 5 | System maintainability; maintainability indicators; systems availability. | -””- | 2 |
| Lecture 6 | The system concept; Reliability of series and parallel composite systems. | -””- | 2 |

| | | | |
|---|---|---|---|
| Lecture 7 | Maintenance: definition, areas of action and responsibility. | -””- | 2 |
| Lecture 8 | Maintenance: definition, areas of action and responsibility. | -””- | 2 |
| Lecture 9 | Organization and planning of the equipment repair activity; basic norms in the maintenance activity. | -””- | 2 |
| Lecture 10 | Maintenance systems; maintenance strategies. | -””- | 2 |
| Lecture 11 | Maintenance systems; maintenance strategies. | -””- | 2 |
| Lecture 12 | Total productive maintenance: concept, objectives | -””- | 2 |
| Lecture 13 | Management methods of the maintenance activity | -””- | 2 |
| Lecture 14 | Technical diagnostics of mechatronic systems | -””- | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Calculation of the reliability of a product, experimental reliability analysis – applications. | Individual study of the work stands followed by practical tests and laboratory equipment; experiment used as method. | 2 |
| Laboratory 2 | Calculation of the reliability of a product, experimental reliability analysis – applications. | -“”- | 2 |
| Laboratory 3 | Analysis of the operation of a mechatronic production system – applications. | -“”- | 2 |
| Laboratory 4 | Repair of technical systems and machines - application on machines in the laboratory. | -“”- | 2 |
| Laboratory 5 | Technical diagnosis and removal of defects in laboratory equipment. | -“”- | 2 |
| Laboratory 6 | Technical diagnostics and troubleshooting of mechatronic systems in the laboratory. | -“”- | 2 |
| Laboratory 7 | Case study regarding the maintenance of mechatronic systems in specialized companies. | -“”- | 2 |
| | | **Total laboratory hours:** | **14** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Fleser T. - Mentenanta utilajelor tehnologice, Ed. OID. ICM, Bucuresti, 1998. |
| | Popp, I. – Exploatarea, reglarea şi întreţinerea mşinilor unelte, Ed. ULB, Sibiu, 2003 |
| | Popp, I. – Mentenanta sistemelor tehnice – note de curs |
| | Popp, I. – Indrumar de lucrari de laborator de mentenanta – fascicola |

| | |
|---|---|
| | Deneş, C. - Fiabilitatea şi mentenabilitatea sistemelor tehnice. Sibiu, Editura „Alma Mater", 2003 |
| | Marc, Gabriel - Managementul activitatii de mentenanta, Ed. Facla, Timisoara, 1999 |
| | Teodorescu N., Mentenanta generala in domeniul ingineriei mecanice, Ed. Agir, Bucuresti, 2008 |
| | Baron, T, s.a., - Calitate si fiabilitate, vol. I si II, Ed. Tehnica Bucuresti, 1988. |
| | Deliu, M.: Fiabilitatea maşinilor-unelte, Editura Universităţii Transilvania din Braşov, 2002 |
| 9.2. Additional Bibliography | Martinescu, I., Popescu, I.: Analiza fiabilităţii şi securităţii sistemelor, Editura Universităţii Transilvania din Braşov, 2002 |
| | Mărăscu-Klein, V., Toma, V.: Managementul mentenanţei, Editura Universităţii Transilvania din Braşov, 2007. |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 70% (minimum 5) | written |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | *CPE* |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | % minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Mihai-Octavian POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1. Name of course | Programmable controllers | | | Code | MCTEN.707.DA | | |
| 2.2. Course coordinator | Prof. PhD. Radu-Eugen BREAZ | | | | | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. PhD. Adrian-Iosif MAROȘAN | | | | | | |
| 2.4. Year of study[2] | 3 | 2.5. Semester[3] | 5 | 2.6. Evaluation form[4] | E | | |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | D | | | | |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 14 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 28 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Computer programming and programming languages, Digital electronics, Electrical actuators, Hydronics and pneutronics 1, 2 |
| 4.2. Competencies | Basic programming knowledge (algorithms), basic knowledge of electronics, basic knowledge of logic functions and circuits, basic knowledge of electrical drives, basic knowledge of hydraulic and pneumatic drives |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video projector, online platforms, etc. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Specific software packages for programmable controllers (PLC) programming |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | design automation components | 0.6 |
| | PC2 | simulate mechatronic design concepts | 0.6 |
| | PC3 | execute analytical mathematical calculations | 0.6 |
| | PC4 | analyse test data | 0.6 |
| | PC5 | develop mechatronic test procedures | 0.5 |
| | PC6 | think abstractly | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0.2 |
| | TC2 | create solutions to problems | 0.2 |
| | TC3 | manage personal professional development | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring knowledge and competences regarding the use and programming of programmable logic controllers (PLC) |
| 7.2. Specific course objectives | It is anticipated that after studying this discipline, the students will be able to:<br>• Define and operate with basic concepts of PLC's programming<br>• Identify the relationships between PLC automation systems and their structure<br>• Design and implement, individually or in a team PLC automation systems |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Programmable logic controllers, generalities, short history. | Heuristic conversation Explanation Case study | 2 |
| Lecture 2 | The structure of PLC's. The central processing unit (CPU). The memory. Types of memories. The structure and capacity of the memory. The interaction between the memory and the input/output variables. The power supply. | - " - | 2 |
| Lecture 3 | The digital input/output system. Types of digital inputs. Types of digital outputs. Input/output modules. Extension modules. Connecting the digital inputs/outputs. | - " - | 2 |
| Lecture 4 | The analog input/output system. Input/output analog signals. Representing the input/output analog data. Connecting the analog inputs/outputs. Serial communication. | - " - | 2 |

| | | | |
|---|---|---|---|
| Lecture 5 | Programming the PLC's, types of programming languages. The ladder diagrams. The equivalence between relay diagrams – ladder diagrams. | - " - | 2 |
| Lecture 6 | Program control execution instructions. Arithmetic instructions. Data manipulation and transfer instructions. Special instructions. | - " - | 2 |
| Lecture 7 | Function blocks diagram programming. Creation of function blocks diagrams. Programming examples. Instructions lists programming. Advanced techniques of programming. Flip-flops programming. Timers and counters. | - " - | 2 |
| Lecture 8 | GRAFCET standard. Programming in SFC (sequential function control) language. Applications. Part I. | - " - | 2 |
| Lecture 9 | GRAFCET standard. Programming in SFC (sequential function control) language. Applications. Part II. | - " - | 2 |
| Lecture 10 | Complex programs. Defining the control task. Control strategy. Structuring and organizing the programs. Programming the digital inputs/outputs. Programming the analog inputs/outputs. | - " - | 2 |
| Lecture 11 | Automating electrical actuation systems. Induction motors automation diagrams. | - " - | 2 |
| Lecture 12 | Automating hydraulic and pneumatic actuation devices. Automating simple movements cycles. | - " - | 2 |
| Lecture 13 | Connecting PLC's in networks. Principles, topology. Network standards (Devicenet, CANbus, Controlnet, Ethernet, Profibus, Sercos). Communication environments. Network communication instructions. | - " - | 2 |
| Lecture 14 | Control systems for servomotors based upon PLC's. PID control. | - " - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Omron CPM programmable controllers. How to connect inputs and outputs. Familiarity with CX Programmer software. Communication between the PLC and the computer. | Heuristic conversation Demonstration Experiment | 2 |

| | | | |
|---|---|---|---|
| Laboratory 2 | Programming examples using Omron CPM PLCs. Ladder diagram programming. Programming with instruction lists. | - ” - | 2 |
| Laboratory 3 | Rockwell / Allen-Bradley Micro 800 PLC. How to connect inputs and outputs. Familiarization with the Connected Components Workbench programming software. Communication between the PLC and the computer. | - ” - | 2 |
| Laboratory 4 | Programming examples using the Rockwell / Allen-Bradley Micro 800 PLC. Ladder diagram programming. Programming with instruction lists. | - ” - | 2 |
| Laboratory 5 | Siemens SIMATIC S7-200 programmable controller. How to connect inputs and outputs. Familiarization with STEP 7 MicroWin programming software. Communication between the PLC and the computer. | - ” - | 2 |
| Laboratory 6 | Programming examples using the Siemens SIMATIC S7-200 PLC. Ladder diagram programming. Programming with instruction lists. | - ” - | 2 |
| Laboratory 7 | TIA Portal programming environment. Types of variables. | - ” - | 2 |
| Laboratory 8 | TIA Portal programming environment. Ladder diagram programming. The main types of instructions. | - ” - | 2 |
| Laboratory 9 | TIA Portal programming environment. Ladder diagram programming. The main types of instructions. Part I. | - ” - | 2 |
| Laboratory 10 | TIA Portal programming environment. Ladder diagram programming. The main types of instructions. Part II. | - ” - | 2 |
| Laboratory 11 | TIA Portal programming environment. Programming in SFC (sequential function control) language. | - ” - | 2 |
| Laboratory 12 | TIA Portal programming environment 15. Applications with SIMATIC S7-1200 PLC. | - ” - | 2 |
| Laboratory 13 | TIA Portal programming environment 15. Applications with SIMATIC S7-1200 and SIMATIC S7-1500 PLC. | - ” - | 2 |
| Laboratory 14 | Bosch ctrlX Automation programming environment. Applications. | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|

| | | | |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| **Total other practical activities hours:** | | | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Breaz, R., *PLC programming - course* (digital format) |
| | Breaz, R., *Automatizări industriale*, Editura Universității din Sibiu, 2007 |
| | Breaz, R.E., Bogdan, L. *Automatizări în sisteme de producție,* Editura Universității din Sibiu, 2003 |
| 9.2. Additional Bibliography | Mărgineanu I., A*utomate programabile*, Ed. Albastră, Cluj-Napoca, 2005 |
| | Mărgineanu I., *Utilizarea automatelor programabile în controlul proceselor*, Ed. Albastră, Cluj-Napoca, 2010 |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 65% (minimum 5) | Written questionnaire |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 35% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29]<br>• Knowledge and understanding of basic working principles PLC's and ability to realize simple programs for them<br>• Understanding the functioning of PLC automation systems and ability to integrate them in simple automation diagrams<br>• Ability to recommend a PLC automation systems according to the application | | | | 50% (minimum 5) |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Prof. PhD. Radu-Eugen Breaz | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1. Name of course | Dynamics of mechatronic systems | | | Code | MCTEN.708.DA | | |
| 2.2. Course coordinator | Prof. PhD. Radu-Eugen BREAZ | | | | | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. PhD. Iosif-Adrian MAROȘAN | | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 4 | 2.6. Evaluation form[4] | E | | |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | D | | | | |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 14 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 28 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **125** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Mathematical analysis, Fundamentals of automated systems |
| 4.2. Competencies | Basic knowledge of solving differential equations, general knowledge of continuous linear control systems |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Whiteboard, video projector, online platforms, etc. |
| 5.2. For practical activities (lab/sem/pr/app) [16] | MATLAB & Simulink software package |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | design automation components | 0.6 |
| | PC2 | simulate mechatronic design concepts | 0.6 |
| | PC3 | execute analytical mathematical calculations | 0.6 |
| | PC4 | analyse test data | 0.6 |
| | PC5 | develop mechatronic test procedures | 0.5 |
| | PC6 | think abstractly | 0.5 |
| **6.2. Transversal competencies** | TC1 | synthesise information | 0.2 |
| | TC2 | create solutions to problems | 0.2 |
| | TC3 | manage personal professional development | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Acquiring knowledge and skills on the dynamics of mechatronic systems |
| 7.2. Specific course objectives | It is anticipated that after studying this discipline, the students will be able to:<br>• to define the basic concepts in the field of dynamic systems;<br>• identify the relationships between the components of dynamical systems;<br>• to build the mathematical model of a dynamic system. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Dynamic system, mechanical system. Dynamic machining system. Classification of dynamic systems. The elastic structure of the machine tool. | Heuristic conversation Explanation Case study | 2 |
| Lecture 2 | Dynamic models. Dynamic models of the elastic structure. Models of the dynamic cutting process. | - ” - | 2 |
| Lecture 3 | Dynamic models of actuation systems (motors). Dynamic models of the friction process. | - ” - | 2 |
| Lecture 4 | Basic problems in the study of time-invariant linear dynamical systems. System response and mode of operation. Free regime. Forced regime. Static mode. | - ” - | 2 |
| Lecture 5 | Static rigidity. Calculation of static stiffness. Experimental determination of static stiffness. | - ” - | 2 |
| Lecture 6 | Dynamic identification of machine tool structures. General considerations. Basic principles of testing elastic structures. Installations used for identification. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 7 | Stability of the dynamic machining system. Notions of stability and instability. Methods for the analysis of the dynamic machining system. | - ” - | 2 |
| Lecture 8 | Ways to reduce vibration and noise levels in machine and equipment systems. | - ” - | 2 |
| Lecture 9 | Increasing dynamic stiffness. Constructive measures to increase the stability of the dynamic machining system | - ” - | 2 |
| Lecture 10 | Dynamic models of robots. Euler-Lagrange method. | - ” - | 2 |
| Lecture 11 | Applications of the Euler-Lagrange method. | - ” - | 2 |
| Lecture 12 | Dynamic models of robots. Newton-Euler method. | - ” - | 2 |
| Lecture 13 | Computer aided modeling of dynamic systems. Techniques and methodologies. | - ” - | 2 |
| Lecture 14 | Computer aided simulation of dynamic systems. Software tools. The advantages of simulation. The main limitations of simulation software tools. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Study of the stability of dynamic systems using the MATLAB & Simulink environment | Heuristic conversation Demonstration Experiment | 2 |
| Laboratory 2 | Realization of mathematical models and simulation of dynamic systems using the MATLAB & Simulink environment. Model of a direct current electric motor. | - ” - | 2 |
| Laboratory 3 | Realization of mathematical models and simulation of dynamic systems using the MATLAB & Simulink environment. Model of a hydraulic motor. | - ” - | 2 |
| Laboratory 4 | Realization of mathematical models and simulation of dynamic systems using the MATLAB & Simulink environment. Model of a feed kinematic chain. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Laboratory 5 | Tuning the PID controllers of the feed kinematic chain using the Control System Designer interface in MATLAB. | - ” - | 2 |
| Laboratory 6 | Realization of mathematical models and simulation of dynamic systems using the MATLAB & Simulink environment. The model of a robotic axis. | - ” - | 2 |
| Laboratory 7 | Tuning the PID controllers of the robotic axis using the Control System Designer interface in MATLAB. | - ” - | 2 |
| Laboratory 8 | Realization of mathematical models and simulation of dynamic systems using the MATLAB & Simulink environment. Modeling the stick-slip phenomenon | - ” - | 2 |
| Laboratory 9 | Study of the dynamics of a two-axis motion control system. | - ” - | 2 |
| Laboratory 10 | Introduction to the Simscape Multibody environment. | - ” - | 2 |
| Laboratory 11 | Modeling and simulation of a manipulator with two degrees of freedom in the Simscape Multibody environment. | - ” - | 2 |
| Laboratory 12 | Realization in the Simscape Multibody environment of the KUKA KR 210 industrial robot model. Part I. | - ” - | 2 |
| Laboratory 13 | Realization in the Simscape Multibody environment of the KUKA KR 210 industrial robot model. Part II. | - ” - | 2 |
| Laboratory 14 | Fuzzy control systems. Simulation of dynamic systems control using the MATLAB & Simulink environment and Fuzzy Logic Toolbox. Tuning fuzzy regulators. | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |

| | | | |
|---|---|---|---|
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| **Total other practical activities hours:** | | | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Chiriacescu , S., ș.a., *Dinamica mașinilor unelte - prolegomene*, Editura Tehnică, București, 2004 |
| | Ispas C., Simion, F.P., *Vibrațiile mașinilor unelte. Teorie și aplicații,* Editura Academiei Române, 1986 |
| 9.2. Additional Bibliography | Deacu, L., Pavel Gh., *Vibrații la mașini unelte*, Editura Dacia, Cluj Napoca, 1975 |
| | Weck, M., Werkzeugmaschinen, Band 3, *Automatisierung und Steuerungtechnik,* VDI Verlag, Düsseldorf, 1989 |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 65% (minimum 5) | Written questionnaire |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 35% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29]<br>• ability to calculate equivalent continuous transfer functions for simple block schemes; | | | | | 50% (minimum 5) |

| | |
|---|---|
| • knowledge of simple mathematical models of dynamic systems of machines and equipment<br>• knowledge of stability criteria for dynamic systems;<br>• the ability to recommend simple measures to improve the behavior of dynamic systems of machines and equipment. | |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Prof. PhD Radu-Eugen Breaz | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Flexible manufacturing systems 2 | Code | MCTEN.801.SO |
| 2.2. Course coordinator | Assoc. prof. dr. ing. Mihai CRENGANIȘ | | |
| 2.3. Seminar/laboratory coordinator | Assoc. prof. dr. ing. Alexandru BÂRSAN | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | IV | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 4 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 2 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **8** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **50** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **2** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Fundamentals of robotics, Microcontroller programming, Sensors and sensing systems, Fundamentals of mechatronic systems, Electronics, Fundamentals of automatic systems |
| 4.2. Competencies | Knowledge of Industrial Drives, Fundamentals of Automatic Systems, Fundamentals of Mechatronic Systems, Computer Aided Design |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and applied presentations, Reading recommended bibliography |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Preparation and defense of planned work. Active participation, Reading recommended bibliography |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | simulates mechatronic design concepts | 0.4 |
| | PC2 | develop mechatronic test procedures | 0.2 |
| | PC3 | describes the electrical drive system | 0.2 |
| | PC4 | tests mechatronic units | 0.2 |
| | PC5 | designs prototypes | 0.2 |
| | PC6 | designs automation components | 0.2 |
| **6.2. Transversal competencies** | TC1 | synthesizes information | 0.2 |
| | TC2 | finds solutions to problems | 0.2 |
| | TC3 | thinks abstractly | 0.2 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | Developing students' skills in the design, implementation and optimization of flexible manufacturing systems (FMS), with a special focus on the effective integration of industrial robots and automation technologies |
| 7.2. Specific course objectives | Understanding the fundamental concepts of flexible manufacturing systems<br>Classifying and analyzing the types of robots used in FFFS<br>Applying kinematics and dynamics principles to industrial robots<br>Setting up and operating automated handling and transfer systems<br>Integration of sensors and sensing systems in production processes<br>Implementing robot control and monitoring techniques in the production line<br>Optimizing production flow through performance analysis and evaluation techniques<br>Application of IoT and AI technologies to improve the flexibility and autonomy of SFF<br>Realizing a full simulation project of a flexible manufacturing system |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Advanced Kinematics for Serial and Parallel Robots | The classic lecture (synthetic presentation, explanations, demonstration through diagrams, graphs) supported by | 2 |

| | | | |
|---|---|---|---|
| | | the use of image projection tools / problem-based learning, learning through discovery, experiment, and case study. | |
| Lecture 2 | Introduction to manipulation and transfer systems (autonomous guided vehicles) | - ” - | 2 |
| Lecture 3 | Handling and transfer systems concepts (indexing systems) | - ” - | 2 |
| Lecture 4 | Understanding handling and transfer systems (industrial manipulators) Robot Gripping Systems | - ” - | 2 |
| Lecture 5 | Path Optimization and Production Delays | - ” - | 2 |
| Lecture 6 | RI specific kinematic schemes | - ” - | 2 |
| Lecture 7 | Space Management and Internal Logistics in FMS | - ” - | 2 |
| Lecture 8 | Types of Sensors Used in Robots and FMS | - ” - | 2 |
| Lecture 9 | Environmental Perception and Machine Vision | - ” - | 2 |
| Lecture 10 | Perception Systems Integrated in FMS | - ” - | 2 |
| Lecture 11 | Integration of Sensors for Monitoring and Control | - ” - | 2 |
| Lecture 12 | Control Systems in FMS | - ” - | 2 |
| Lecture 13 | Integration of IoT and Data Management in FMS | - ” - | 2 |
| Lecture 14 | Using Artificial Intelligence in Flexible Systems | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Work protection instructions, laboratory and thematic presentation, automation concept | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Dimensioning the drive system of industrial conveyors, VGAs | - ” - | 2 |
| Laboratory 3 | Drive system dimensioning of indexing table systems | - ” - | 2 |
| Laboratory 4 | Drive system dimensioning of manipulators | - ” - | 2 |
| Laboratory 5 | Integration of a robot and a material transfer conveyor | - ” - | 2 |
| Laboratory 6 | Simulating kinematics for a serial robot in Simulink | - ” - | 2 |
| Laboratory 7 | PID control exercise for a robot arm | - ” - | 2 |
| | | **Total laboratory hours:** | 14 |

| 8.2.c. Project | Teaching methods[24] | Hours |
|---|---|---|
| **Total project hours:** | | |

| 8.2.d. Other practical activities | Teaching methods | Hours |
|---|---|---|
| **Total other practical activities hours:** | | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Telea, D., Roboti, Ed. Dacia Cluj-Napoca, 2001 |
| | Telea, D., Mașini, echipamente si strategii in SFP, Ed. Univ.L Blaga, 2009 |
| | Telea, D., Bazele roboticii Ed.Univ.L Blaga, Sibiu, 2010 |
| | Telea, D. & Crenganis M. Roboti industriali. Ed.Univ.L Blaga, Sibiu, 2016 |
| | Chicea A. & Crenganis M. Bazele sistemelor mecatronice, Ed.Univ.L Blaga, Sibiu, 2017 |
| | Crenganis M. & Chicea A. Mecatronica roboților si manipulatoarelor industriale Ed.Univ.L Blaga, Sibiu, 2018 |
| | Giurgiutiu V., Lyshevski S.E., *Micromechatronics*, CRC Press, Inc.2004, ISBN: 0-8493-1593 |
| | Mogan G.L., Proiectarea constructivă a sistemelor mecanice ale produselor mecatronice, Ed. Univ. Transilvania, Braşov, 2003 |
| | Taraboanta F. - Mecatronica generala, Ed. Gh. Asachi, Iasi, 2002 |
| | Bishop H. Robert, *The Mechatronics Handbook*, CRC Press, London-New York-Washington, 2002 |
| | |
| | |
| | |
| 9.2. Additional Bibliography | Crenganis M. & Chicea A. Redundanta roboților seriali si industriali Ed.Univ.L Blaga, Sibiu, 2020 |
| | Fu K. S., Gonzalez R. C., Lee C. S. G., Robotics, Mc Graw-Hill, 1987. |
| | Ivănescu M., Roboţi industriali, Edit. Universitaria, Craiova, 1994. |
| | |
| | |
| | |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through periodic discussions in formal and informal settings with representatives of specialized companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 30% | 70% (minimum 5) | Oral |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 70% (min. 5) | | |

| | | | | |
|---|---|---|---|---|
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | 30% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | Grade 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assoc. prof. PhD Mihai Crenganis | |
| **Study Program Coordinator** | Assoc. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **"Lucian Blaga " University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Machines and Industrial Equipments |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | License |
| 1.6. Programme of study/qualification | Mechatronics/Engineer |

## 2. Course Information

| | | | | | |
|---|---|---|---|---|---|
| **2.1.** Name of course | Mechatronic systems | | | Cod | MCTEN.803.DO |
| **2.2.** Course coordinator | conf.dr.ing. Gîrjob Claudia-Emilia | | | | |
| **2.3.** Seminar/laboratory coordinator | Asist.drd.ing. Morariu Timotei | | | | |
| **2.4.** Year of study[2] | IV | **2.5.** Semester[3] | 8 | **2.6.** Evaluation form[4] | E |
| **2.7.** Course type[5] | O | **2.8.** The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| **3.1.** Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| **3.2.** Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Nr. ore** |
|---|---|
| Learning by using course materials, references and personal notes | 8 |
| Additional learning by using library facilities, electronic databases and on-site information | 8 |
| Preparing seminars / laboratories, homework, portfolios and essays | 3 |
| Tutorial activities[9] | 7 |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours**[11] ***(NOSI$_{sem}$)*** | **19** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester**[12] **(*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits**[13] | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| **4.1.** Courses that must be successfully completed first<br>**4.2.** (from the curriculum)[14] | Fundamentals of robotics, Programming of microcontrollers |
| **4.3.** Competencies | Competente de operare pe calculator (minimal: Office, browser internet). |

**5. Conditions** (where applicable)

| | |
|---|---|
| **5.1.** For course/lectures[15] | • |
| **5.2.** For practical activities<br>**5.3.** (lab/sem/pr/app) [16] | • |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | develop mechatronic test procedures | 1 |
| | PC2 | test mechatronic units | 0.5 |
| | PC3 | keep up with digital transformation of industrial processes | 0.5 |
| **6.2. Transversal competencies** | TC1 | think abstractly | 1 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| **7.1.** Main course objective | The discipline aims to provide knowledge, skills, abilities and habits regarding: the structure of mechatronic systems, modeling of mechatronic systems; sensors and transducers used in mechatronics; applications of mechatronics. |
| **7.2.** Specific course objectives | • The acquisition of concepts and skills to understand, design and operate mechatronic systems in various fields of social life;<br>• Gaining knowledge on the structure of mechatronic systems hardware;<br>• Understanding structural modeling techniques mechatronic systems;<br>• Formation of creative thinking and teamwork. |

**8. Content**

| **8.1. Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to Mechatronics. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 2 | Examples of mechatronic systems. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 3 | Structure and functions of mechatronic systems. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 4 | Mathematical modeling of structure elements of mechatronic systems. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 5 | Sensors and transducers used in mechatronics. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 6 | Sensors and transducers used in mechatronics | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 7 | Mechatronics applied in robotics. Introduction. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 8 | Mechatronics applied in robotics. Classification. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 9 | The structure of industrial robots. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 10 | Mechatronics applied computing. | Classical lecture, assisted by use of modern design images | 2 |

| **8.1. Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 11 | Mechatronics in automotive technology. Introduction | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 12 | Mechatronics in automotive technology. Aplication. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 13 | Mechatronics in biomedical engineering. | Classical lecture, assisted by use of modern design images | 2 |
| Lecture 14 | Trends in mechatronics. | Classical lecture, assisted by use of modern design images | 2 |
| | | **Total ore curs:** | **28** |

| **8.2. Practical activities (8.2.a. Seminar22/ 8.2.b. Laboratory23/ 8.2.c. Project24)** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| **Act.1** | Safety. Presentation of the laboratory. | experimentul, metodele euristice | 2 |
| **Act.2** | Study sensors used in mechatronics function of perception. | experimentul, metodele euristice | 2 |
| **Act.3** | Study proximity sensors. | experimentul, metodele euristice | 2 |
| **Act.4** | Mechanical structure of an industrial robot system. | experimentul, metodele euristice | 2 |
| **Act.5** | Drive structure of an industrial robot. | experimentul, metodele euristice | 2 |
| **Act.6** | The structure and operation of storing information. | experimentul, metodele euristice | 2 |
| **Act.7** | Operating an air flow meter. | experimentul, metodele euristice | 2 |
| **Act.8** | Construction and operation of a motor vehicle ABS. | experimentul, metodele euristice | 2 |
| **Act.9** | Construction of motor vehicle safety systems: safety belts, air bags. | experimentul, metodele euristice | 2 |
| **Act.10** | Study navigation systems - GPS. | experimentul, metodele euristice | 2 |
| **Act.11** | Study prostheses, orthoses and exo-skeletons amplifiers used in medicine. | experimentul, metodele euristice | 2 |
| **Act.12** | Data acquisition systems. | experimentul, metodele euristice | 2 |
| **Act.13** | Processing and representation of experimental data. | experimentul, metodele euristice | 2 |
| **Act.14** | Final evaluation. | experimentul, metodele euristice | 2 |
| | | **Total seminar/laboratory hours:** | 28 |

## 9. Bibliography


| | |
|---|---|
| **9.1** Recommended Bibliography | Giurgiutiu V., Lyshevski S.E., *Micromechatronics*, CRC Press, Inc.2004, ISBN: 0-8493-1593- |
| | Mogan G.L., Proiectarea constructivă a sistemelor mecanice ale produselor mecatronice, Ed. Univ. Transilvania, Braşov, 2003 |
| | Taraboanta F. - Mecatronica generala, Ed. Gh. Asachi, Iasi, 2002 |
| | Bishop H. Robert, *The Mechatronics Handbook*, CRC Press, London-New York-Washington, 2002 |
| **9.2** Referințe bibliografice suplimentare | Bolton, W., *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering* (6th ed.). Pearson Education Limited. ISBN 978-1-292-07668-3, 2015 |
| | Onwubolu, G. C. *Mechatronics: Principles and Applications*. Elsevier Butterworth-Heinemann. ISBN 0-7506-6379-0, 2005 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

| |
|---|
| It is carried out through regular discussions in a formal and informal setting with the representatives of the profile companies |

**10 Evaluare**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 20% | 70% (minimum 5) | scris |
| | | Homework: | 10% | | |
| | | Other activities[28]: | 10% | | |
| | | Final evaluation: | 60% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 30% (minimum 5) | CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Standard minim de performanță[29] | | | | | Nota 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs***

Filling Date: 16.09.2024

Department Acceptance Date: 30.09.2024

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Conf. dr. ing. Claudia-Emilia GÎRJOB | |
| **Study Program Coordinator** | Conf.dr.ing. Mihai Crenganiș | |
| **Head of Department** | Conf. dr. ing. Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Department of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Virtual Manufacturing | Code | MCTEN.804.SO |
| 2.2. Course coordinator | Lecturer PhD. Radu Emanuil Petruse | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Radu Emanuil Petruse | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 1 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 14 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 20 |
| Additional learning by using library facilities, electronic databases and on-site information | 17 |
| Preparing seminars / laboratories, homework, portfolios and essays | 10 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **19** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Technical drawing, CAD-CAM methods, Manufacturing technologies |
| 4.2. Competencies | Computer aided Design (CAD) and manufacturing technologies |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation, discussions, comments and application presentations |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Elaboration and support of planned works. Active participation. Reading the recommended bibliography |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | adjust engineering designs | 0.5 |
| | PC2 | define technical requirements | 0.5 |
| | PC3 | prepare production prototypes | 0.5 |
| | PC4 | keep up with digital transformation of industrial processes | 0.5 |
| | PC5 | perform test run | 0.5 |
| | PC6 | use CAM software | 0.5 |
| **6.2. Transversal competencies** | TC1 | coordinate engineering teams | |
| | TC2 | manage personal professional development | |
| | TC3 | apply blended learning | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The discipline aims at acquiring the knowledge regarding the means and procedures of computer-assisted manufacturing of products. |
| 7.2. Specific course objectives | It is anticipated that through the course of study of the discipline students will be able to:<br>• to design a virtual manufacturing system, to simulate its operation;<br>• evaluate a virtual manufacturing system. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Getting started with manufacturing systems - Types of manufacturing systems:<br>a. Manufacturing systems with based on material addition technologies<br>b. Material removal manufacturing systems | Lecture, hands on exercises, demonstrations using physical equipment and using immersive technologies (e.g. Virtual Reality) | 2 |
| Lecture 2 | Getting started with the principles of operation and kinematics of manufacturing systems with based on material addition technologies | - ” - | 2 |
| Lecture 3 | Identify the types of products suitable for manufacture through manufacturing technologies with the addition of material | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Simulation methods and virtual validation of the manufacturing process with the addition of material | - ” - | 2 |
| Lecture 5 | Getting started with the operating principles and kinematics of material removal manufacturing systems | - ” - | 2 |
| Lecture 6 | Getting started with the operating principles and kinematics of material removal manufacturing systems | - ” - | 2 |
| Lecture 7 | Simulation methods and virtual validation of material removal manufacturing systems | - ” - | 2 |
| Lecture 8 | Design and simulation of virtual manufacturing equipment for material removal manufacturing processes.<br>Part 1-realization of the processing system | - ” - | 2 |
| Lecture 9 | Design and simulation of virtual manufacturing equipment for material removal manufacturing processes.<br>Part 2-preparation of the system for processing simulation | - ” - | 2 |
| Lecture 10 | Virtual simulation methods for planar machining by 3-axis milling. | - ” - | 2 |
| Lecture 11 | Virtual simulation methods for pocket processing by 3-axis milling. | - ” - | 2 |
| Lecture 12 | Virtual simulation methods for 3-axis milling contouring processing. | - ” - | 2 |
| Lecture 13 | Virtual simulation methods for external machining by turning. | - ” - | 2 |
| Lecture 14 | Methods for generating documentation and numerical code for simulated processing. | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.b. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Preparation and assembly of the components that will define the virtual manufacturing system | Practical demonstration, exercise, experiment | 2 |
| Laboratory 2 | Identification of the kinematic joints required by the virtual manufacturing system | - ” - | 2 |
| Laboratory 3 | Virtual simulation for planar machining by milling in 3 axes. | - ” - | 2 |
| Laboratory 4 | Virtual simulation for the processing of the pockets by milling in 3 axes. | - ” - | 2 |
| Laboratory 5 | Virtual simulation for contouring processing by milling in 3 axes. | - ” - | 2 |
| Laboratory 6 | Virtual simulation for external processing by turning. | - ” - | 2 |
| Laboratory 7 | Generation of documentation and numerical code for simulated processing. | - ” - | 2 |
| | | **Total laboratory hours:** | 14 |

| **8.2.c. Project** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Project 1 | Choosing the project theme and creating the CAD model of the manufacturing system | Case study, demonstration, exercise, error analysis etc. | 2 |
| Project 2 | Applying the required kinematic joints to the chosen virtual manufacturing system. | - ” - | 2 |

| | | | |
|---|---|---|---|
| Project 3 | Virtual simulation for the roughing processing necessary for the chosen project theme. | - ” - | 2 |
| Project 4 | Virtual simulation for the finishing processing necessary for the chosen project theme. | - ” - | 2 |
| Project 5 | Virtual simulation for contouring processing necessary for the chosen project theme. | - ” - | 2 |
| Project 6 | Virtual simulation for processing the pockets and holes necessary for the chosen project theme. | - ” - | 2 |
| Project 7 | Generation of documentation and numerical code for simulated processing. | - ” - | 2 |
| | | **Total project hours:** | 14 |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | T. S. Srivatsan and T. S. Sudarshan, ”Additive Manufacturing Innovations, Advances, and Applications” , 2015 eBook ISBN: 978-1-4987-1478-5 |
| | Steinar Westhrin Killi ”Additive Manufacturing: Design, Methods, and Processes”, 2017 ISBN 978-1-315-19658-9 (eBook) |
| | Bondrea, I., Avrigean, E., Optimizarea produselor şi proceselor tehnologice de prelucrare, Ed. Universităţii, Sibiu 2001. |
| | Lasse Berntzen, Umar Burki, Marius Johannessen, Eugen Avrigeanu, Ioan Bondrea, Bogdan Chiliban, Valentin Grecu, **Radu Petruse**, Teresa Goncalves, Jose Saias, ”The Digital Factory: Concepts, Implementations, Present and Future Challenges” 2015 |
| 9.2. Additional Bibliography | Bondrea, I., Modelarea şi simularea sistemelor de producţie, Sibiu, 1999. |
| | Bondrea, I., Avrigean, E., Proiectarea constructivă şi tehnologică asistată de calculator, Ed. Universităţii, Sibiu 2002. |

## 10. Conjunction of the discipline’s content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[24]

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[25] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[26]: | % | 70% (minimum 5) | |
| | | Homework: | 0% | | |
| | | Other activities[27]: | % | | |
| | | Final evaluation: | 70% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | % (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc. | | 15% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| | of tools, processing and interpretation of results | • Practical demonstration | | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | 15% (minimum 5) | |
| 11.5 Minimum performance standard[28] | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Radu Emanuil Petruse | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai Crenganiș | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *Case study, demonstration, exercise, error analysis, etc.*
[24] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[25] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[26] *The number of tests and the weeks in which they will be taken will be specified*
[27] *Scientific circles, professional competitions, etc.*
[28] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor's degree |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Finite elements analysis | Code | MCTEN.805.SO |
| 2.2. Course coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |
| 2.3. Seminar/laboratory coordinator | Lecturer PhD. Gabriela-Petruța POPP | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | E |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 2 | 0 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 28 | 0 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 8 |
| Additional learning by using library facilities, electronic databases and on-site information | 8 |
| Preparing seminars / laboratories, homework, portfolios and essays | 3 |
| Tutorial activities[9] | 7 |
| Exams[10] | 4 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **19** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **56** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **75** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **3** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Knowledge of technical drawing, materials strength, computer-aided design. |
| 4.2. Competencies | Computer operating skills (minimum: Excel, Word).<br>Skills in using computer-aided design software (Catia, Proengineering, SolidWorks, etc.).<br>Programming skills. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | • Active participation<br>• Reading course materials |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Active participation in reading recommended bibliography<br>• Preparation and presentation of planned practical works<br>• Active participation |

**6. Specific competencies acquired[17]**

| | | | Number of credits assigned to the discipline[18] 3 | Credits distribution by competencies[19] |
|---|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Execute analytical mathematical calculations | | 0.5 |
| | PC2 | Uses simulation and CAD software | | 0.5 |
| | PC3 | Analyse test data | | 0.5 |
| **6.2. Transversal competencies** | TC1 | Manage personal professional development | | 0.5 |
| | TC2 | Synthesise information | | 0.5 |
| | TC3 | Create solutions to problems | | 0.5 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | The general objective of the course is to provide students with theoretical knowledge and practical skills in the use of the finite element method (FEM) for evaluating and optimizing the behaviour of complex structures and technical systems. Students will learn to apply numerical techniques in the simulation and modelling of electromechanical systems, adhering to safety standards and technical requirements. |
| 7.2. Specific course objectives | At the end of this course, students will be able to:<br>• Apply finite element analysis methods for modelling and simulating the behaviour of mechanical and electromechanical structures.<br>• Utilize CAD software and other computer tools for preparing the geometric models necessary for analysis.<br>• Perform analytical and numerical mathematical calculations for evaluating the structure and operation of technical systems.<br>• Examine fundamental technical principles for the correct interpretation of results obtained from FEM simulations.<br>• Assess the technical feasibility of proposed solutions and adhere to safety standards in the design and testing of technical equipment. |

**8. Content**

| **8.1 Lectures[20]** | | **Teaching methods[21]** | **Hours** |
|---|---|---|---|
| Lecture 1 | Introduction to the Finite Element Method (FEM) | Lecture, Heuristic conversation, Explanation, Case study | 2 |
| Lecture 2 | Basic Concepts of Domain Discretization and Problem Formulation | - ” - | 2 |
| Lecture 3 | Method for Solving Partial Differential Equations using FEM | - ” - | 2 |

| | | | |
|---|---|---|---|
| Lecture 4 | Types of Finite Elements: 1D, 2D, and 3D Elements | - ” - | 2 |
| Lecture 5 | Interaction between Finite Elements | - ” - | 2 |
| Lecture 6 | Mesh Generation Techniques | - ” - | 2 |
| Lecture 7 | Numerical Integration Methods in FEM | - ” - | 2 |
| Lecture 8 | Errors and Accuracy Assessment in FEM Simulations | - ” - | 2 |
| Lecture 9 | Optimizing FEM Models for Performance and Efficiency | - ” - | 2 |
| Lecture 10 | FEM Applications in Structural Analysis | - ” - | 2 |
| Lecture 11 | FEM Applications in Thermal Analysis | - ” - | 2 |
| Lecture 12 | Designing Structures Using FEM (Part I: Initial Design) | - ” - | 2 |
| Lecture 13 | Designing Structures Using FEM (Part II: Optimization and Verification of the Design) | - ” - | 2 |
| Lecture 14 | Case Study: Application of FEM in Mechanical Engineering | - ” - | 2 |
| | | **Total lecture hours:** | **28** |

**8.2 Practical activities**

| **8.2.a. Seminar** | **Teaching methods**[22] | **Hours** |
|---|---|---|
| | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Introduction to FEM Software: Project Setup and Configuration | Theoretical study / Practical applications | 2 |
| Laboratory 2 | Geometry Discretization: Creating the Finite Element Mesh | - ” - | 2 |
| Laboratory 3 | Defining Boundary Conditions and Constraints in FEM Models | - ” - | 2 |
| Laboratory 4 | Static Analysis Using FEM: Studying Stresses and Deformations | - ” - | 2 |
| Laboratory 5 | Simulating Thermal Loads with FEM Methods | - ” - | 2 |
| Laboratory 6 | Heat Transfer Analysis in Structures Using FEM | - ” - | 2 |
| Laboratory 7 | Generating and Using Adaptive Meshes in FEM | - ” - | 2 |
| Laboratory 8 | Numerical Errors and Accuracy Assessment in FEM Simulations | - ” - | 2 |
| Laboratory 9 | Model Optimization and Reducing Computational Complexity in FEM | - ” - | 2 |
| Laboratory 10 | Case Study: Analysis of a Mechanical Frame Using FEM | - ” - | 2 |
| Laboratory 11 | Case Study: Simulating a Plate Under Load in FEM Software | - ” - | 2 |
| Laboratory 12 | Preliminary Dynamic Analysis of Simple Structures Using FEM | - ” - | 2 |
| Laboratory 13 | Using Shell and Solid Elements in FEM Analysis | - ” - | 2 |
| Laboratory 14 | Presenting and Interpreting Results from a Complete FEM Analysis | - ” - | 2 |
| | | **Total laboratory hours:** | **28** |

| **8.2.c. Project** | **Teaching methods**[24] | **Hours** |
|---|---|---|
| | **Total project hours:** | |

| **8.2.d. Other practical activities** | **Teaching methods** | **Hours** |
|---|---|---|
| | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Logan, D. L. (2016). A First Course in the Finite Element Method (6th ed.). Cengage Learning. |
| | Zienkiewicz, O. C., Taylor, R. L., & Zhu, J. Z. (2013). The Finite Element Method: Its Basis and Fundamentals (7th ed.). Butterworth-Heinemann. |
| | Cook, R. D., Malkus, D. S., Plesha, M. E., & Witt, R. J. (2017). Concepts and Applications of Finite Element Analysis (4th ed.). Wiley. |
| | Chandrupatla, T. R., & Belegundu, A. D. (2011). Introduction to Finite Elements in Engineering (4th ed.). Pearson. |
| | Bathe, K. J. (2006). Finite Element Procedures. Prentice Hall. |
| 9.2. Additional Bibliography | Hutton, D. V. (2004). Fundamentals of Finite Element Analysis. McGraw-Hill. |
| | Reddy, J. N. (2019). An Introduction to the Finite Element Method (4th ed.). McGraw-Hill. |
| | Hughes, T. J. R. (2012). The Finite Element Method: Linear Static and Dynamic Finite Element Analysis. Dover Publications. |

## 10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]

It is carried out through periodic discussions in both formal and informal settings with representatives of specialized companies.

## 11. Evaluation

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 60% (minimum 5) | Minimum attendance: 50% at lectures Exam: written and oral |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 100% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 40% (minimum 5) | Minimum attendance: 100% at laboratories CPE |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | | minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Lecturer PhD. Gabriela-Petruța POPP | |
| **Study Program Coordinator** | Assoc. prof. PhD Mihai CRENGANIȘ | |
| **Head of Department** | Assoc. prof. PhD Claudia-Emilia GÎRJOB | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | MECHATRONICS |

## 2. Course Information

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.1. Name of course | Quality Engineering | | | Code | FING.MEI.MCTEN.L.SA.8.2010.C-2.7 | |
| 2.2. Course coordinator | Prof. Claudiu Vasile Kifor | | | | | |
| 2.3. Seminar/laboratory coordinator | Raluca BARSAN | | | | | |
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | | C |
| 2.7. Course type[5] | A | 2.8. The formative category of the course[6] | | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 2 | 0 | 1 | 0 | 0 | **3** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 28 | 0 | 14 | 0 | 0 | **42** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 2 |
| Additional learning by using library facilities, electronic databases and on-site information | 2 |
| Preparing seminars / laboratories, homework, portfolios and essays | 4 |
| Tutorial activities[9] | - |
| Exams[10] | 2 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | 8 |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **50** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **2** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Quality control |
| 4.2. Competencies | MS Office |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | Active participation at classes |
| 5.2. For practical activities (lab/sem/pr/app) [16] | Active participation |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 2 | Credits distribution by competencies[19] |
| **6.1. Professional competencies** | CP1 | Applying basic general and speciality technical knowledge for solving technical problems specific for the field of study Mechatronics and Robotics | 0.4 |
| | CP2 | Creating and using schemes, structural and functional diagrams as well as graphical representations and technical documents specific for the field of study Mechatronics and Robotics | 0.4 |
| | CP3 | Design, manufacturing and maintenance of subsystems and components of mechatronic systems | 0.2 |
| | CP4 | Realizing local automation applications in mechatronics and robotics using typified and non-typified components and partial assemblies as well as CAD resources | - |
| | CP5 | Design, manufacturing and maintenance of electronic control susbsystems of mechatronic systems | - |
| | CP6 | Computer aided design, manufacturing and maintenance of mechatronic systems by integrating component subsystems (mechanical, electronic, optical, informational subsystem etc.) | - |
| **6.2. Transversal competencies** | CT1 | Carrying out professional tasks with precisely identifying goals to be achieved, available resources, conditions for finishing them, work stages, work time and the corresponding deadlines. | 0.3 |
| | CT2 | Responsible execution of pluridisciplinary team work tasks, with the assumption of roles on various hierachical levels | 0.3 |
| | Ct3 | Identifying the need for continuous training and efficient usage of information sources and of computer-aided resources for communication and professional training (Internet portals, specialized software applications, databases) | 0.4 |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | -Understanding the importance of quality for the organization's customers and the possibilities for continuous improvement of the organization's efficiency and effectiveness<br>-Learning the main concepts, principles and methods of quality engineering |

| | |
|---|---|
| 7.2. Specific course objectives | Developing a correct and precise image regarding the role of quality tools and techniques in improving the quality of products and processes |

## 8. Content

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | Quality and Quality Engineering | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 2 | The role of the quality engineer in quality systems | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 3 | External and internal customers | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 4 | The evolution of quality. Factors that influence the competitiveness of organizations | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 5 | Quality models: Deming, Juran, Crosby, Taguchi, Feigenbaum, Kano, Masaki Imai | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 6 | External factors that influence quality | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 7 | Internal factors that influence the quality | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 8 | Techniques for identifying customer requirements and transforming them into technical characteristics | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 9 | Quality Function Deployment | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 10 | Quality tools used in work organization and process efficiency | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 11 | Advanced product and process design | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 12 | Quality tools used in the constructive and technological design of the product | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| Lecture 13 | Analysis of failure modes, their effects and criticalities | heuristic conversation | 2 |

| | | | |
|---|---|---|---|
| | | explication<br>intensified lecture<br>graphic organizer | |
| Lecture 14 | Process modeling and management | heuristic conversation<br>explication<br>intensified lecture<br>graphic organizer | 2 |
| | | **Total lecture hours:** | **28** |

| **8.2.b. Laboratory** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Laboratory 1 | Flow charts | heuristic conversation<br>debate<br>demonstration<br>case study | 2 |
| Laboratory 2 | Cause and effect diagrams | heuristic conversation<br>debate<br>demonstration<br>case study | 2 |
| Laboratory 3 | Pareto analysys | heuristic conversation<br>debate<br>demonstration<br>case study | 2 |
| Laboratory 4 | Quality Function Deployment | heuristic conversation<br>debate<br>demonstration<br>case study | 2 |
| Laboratory 5, 6 | Failure mode and effect analysis | heuristic conversation<br>debate<br>demonstration<br>case study | 4 |
| Laboratory 7 | Six sigma improvement | heuristic conversation<br>debate<br>demonstration<br>case study | 2 |
| | | **Total laboratory hours:** | 14 |

| | |
|---|---|
| **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Oprean, C., Kifor C. V., *Quality Management*, Callidus Publishing House, Germany, ISBN 978 – 3 – 940677-50-1, 2008. |
| | Kifor, C., Quality improvement, Course notes, 2021. |
| 9.2. Additional Bibliography | Evans, J. R. and Lindsay, W. M. *The management and control of quality*, West publishing, 2005. |
| | Bendell, T., *What is six sigma?* Quality World, 2004. |

| | |
|---|---|
| | Stevenson, W. J., Operations Management, McGraw – Hill, ISBN 9780078024108, 2015. |
| | Chen, C., Roth H., *The big book of six sigma*. McGraw – Hill, 2005. |
| | TQM & Business Excellence, Colecţie reviste |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]**

It is carried out through regular discussions in a formal and informal meeting with the representatives of profile companies

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[24] |
|---|---|---|---|---|---|
| 11.4a Exam / Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[25]: | | 80% (minimum 5) | |
| | | Homework: | | | |
| | | Other activities[26]: | | | |
| | | Final evaluation: | | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 20% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | % (minimum 5) | |
| 11.5 Minimum performance standard[27] | | | | | 50% minim |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Data completării: |_2_|_7_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Data avizării în Departament: |_0_|_2_| / |_1_|_0_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|

| | | |
|---|---|---|
| **Course Teacher** | Prof. Claudiu Vasile Kifor | |
| **Study Program Coordinator** | Assoc. prof. PhD Claudia Gîrjob | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Elaboration of the diploma project | Code | FING.MEI.MCTEN.808.SO |
| 2.2. Course coordinator | Assist. PhD. eng. Dan Mihai Rusu | | |
| 2.3. Seminar/laboratory coordinator | Assist. PhD. eng. Dan Mihai Rusu | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 0 | 0 | 0 | 4 | 0 | **4** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 0 | 0 | 0 | 56 | 0 | **56** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 9 |
| Additional learning by using library facilities, electronic databases and on-site information | 10 |
| Preparing seminars / laboratories, homework, portfolios and essays | 25 |
| Tutorial activities[9] | 8 |
| Exams[10] | 6 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **44** |
| **3.4. Total Hours in the Curriculum *(NOAD$_{sem}$)*** | **56** |
| **3.5. Total Hours per Semester[12] *(NOAD$_{sem}$ + NOSI$_{sem}$)*** | **100** |
| **3.6. No. of Hours / ECTS** | **25** |
| **3.7. Number of credits[13]** | **4** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Subjects studied in the curriculum of the specialization. |
| 4.2. Competencies | The general competences are mentioned in the discipline descriptions of the specialization. |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | - |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Active participation in the project development stages;<br>• Complying with the manner and duration of the project;<br>• According to the syllabus, the discipline involves the guidance of the graduate in the elaboration of the stages of the diploma project. |

**6. Specific competencies acquired[17]**

| Number of credits assigned to the discipline[18] | | 4 | Credits distribution by competencies[19] |
|---|---|---|---|
| **6.1. Professional competencies** | PC1 | Forming correct conceptions on the advantages of SFP/CIM and robotic structures. Through the proposed topics, the laboratory work is intended to provide an organic link between theoretical aspects and practical solutions. | |
| | PC2 | Knowledge of computer-aided design methods and techniques. | |
| | PC3 | Knowledge of the structure and functions of mechatronic systems. | |
| | PC4 | | |
| | PC5 | | |
| | PC6 | | |
| **6.2. Transversal competencies** | TC1 | Cultivating creative skills, encouraging flexible thinking. | |
| | TC2 | Ability to tackle and solve complex problems alone or in a team. | |
| | TC3 | Ability to assemble and lead interdisciplinary teams. | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | • The diploma project is a test of professional development and as such, it must follow a certain content, form and scientific level.<br>• The topic of the project must contain research, which may be related to problems of companies, firms, organizations, business or fundamental research, laboratory or contract research and so on.<br>• Graduates must prove through the diploma project that they have mastered correctly and at an appropriate level all the theoretical and practical aspects covered in the specialized subjects studied during the degree course |
| 7.2. Specific course objectives | • The paper must demonstrate advanced scientific knowledge of the topic, contain elements of originality in the development and solution of the topic, as well as ways to validate them scientifically |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | | | |
| Lecture 2 | | | |
| Lecture 3 | | | |
| Lecture 4 | | | |
| Lecture 5 | | | |
| Lecture 6 | | | |
| Lecture 7 | | | |
| Lecture 8 | | | |
| Lecture 9 | | | |
| Lecture 10 | | | |
| Lecture 11 | | | |
| Lecture 12 | | | |
| Lecture 13 | | | |
| Lecture 14 | | | |
| | | **Total lecture hours:** | |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | … | | |
| Laboratory 2 | … | | |
| Laboratory 3 | | | |
| Laboratory 4 | | | |
| Laboratory 5 | | | |
| Laboratory 6 | | | |
| Laboratory 7 | | | |

| | | | |
|---|---|---|---|
| Laboratory 8 | | | |
| Laboratory 9 | | | |
| Laboratory 10 | | | |
| Laboratory 11 | | | |
| Laboratory 12 | | | |
| Laboratory 13 | | | |
| Laboratory 14 | | | |
| | | **Total laboratory hours:** | |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | Setting the topic and the main steps in the development. | Lecture, conversation, consultations, working with books, textbooks, databases, etc., independent reading, individual work, | 4 |
| Project 2 | Study of construction and design principles of machine and production systems. | Data collection, field work, etc.; application of quantitative and qualitative methods of data analysis | 4 |
| Project 3 | Study, knowledge and design of the electrical and electronic systems of machine and production systems. | -””- | 4 |
| Project 4 | Study, knowledge and computer-aided design of hardware and software solutions for the control and microcontroller control of machine and production systems. | -””- | 4 |
| Project 5 | Study and knowledge of the principles of automatic systems, machine intelligence basics. | -””- | 4 |
| Project 6 | Computer-aided design (2D - AutoCAD and 3D - CATIA, ProEngineering, LifeMode-Adams) of machine and production systems. | -””- | 4 |
| Project 7 | Implementation, use and programming of CNC MUs and robots. | -””- | 4 |
| Project 8 | Use of programming languages (C, MATLAB, LabVIEW) in research and development of machine and production systems. | -””- | 4 |
| Project 9 | Modeling and simulation of machine and production systems with applications in industry. | -””- | 4 |
| Project 10 | Ergonomics, reliability and maintenance of machine and production systems. | -””- | 4 |
| Project 11 | Elaboration of a set of measures of labor protection, safety engineering and fire prevention and extinguishing, which will emphasize the graduate's training in this field. | -””- | 4 |
| Project 12 | Synthesis of all the partial conclusions of the whole work, the technico-economic advantages and disadvantages resulting from the comparison with other similar products, originality. | -””- | 4 |
| Project 13 | Specification of the selected bibliography. | -””- | 4 |
| Project 14 | Presentation and support of the project. | -””- | 4 |
| | | **Total project hours:** | 56 |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | | | |
| Act.2 | | | |
| Act.3 | | | |
| Act.4 | | | |
| Act.5 | | | |
| Act.6 | | | |
| Act.7 | | | |
| Act.8 | | | |
| Act.9 | | | |
| Act.10 | | | |
| Act.11 | | | |
| Act.12 | | | |
| Act.13 | | | |
| Act.14 | | | |
| | | **Total other practical activities hours:** | |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended Bibliography | Dulgheru, V., Cantemir, L., Carcea, Maria. Manual de creativitate. Editura "Tehnica-Info", Chişinău, 2000. |
| | Manolea, Gh. Bazele cercetării creative. Editura AGIR, Bucureşti, 2006. |
| | Telea, D., Popp, I., Masini, echipamente si strategii in SFP, Ed. Univ. L.Blaga, Sibiu, 2015 |
| | Hurgoiu, D. Tehnici de achizitie si prelucrare a datelor, Cluj-Napoca, 2004 |
| | Hurgoiu, D. monitorizarea si controlul proceselor de fabricatie, Ed. AGIR, Buc., 2013 |
| | Dolga V., - Sisteme de achizitii de date, interfete si instrumentatie virtuala, Politehnica Timisoara, 2008. |
| | OLEKSIK, V., PASCU, A. *Proiectarea optimală a maşinilor şi utilajelor,* Editura Universităţii „Lucian Blaga” din Sibiu, 2007. |
| | PASCU, A., OLEKSIK, V. Calculul structurilor utilizând metoda elementului finit, Editura Universităţii „Lucian Blaga” din Sibiu, Sibiu, 2014. |
| | Bologa, O., Turcu, N. Deformarea volumică rotativă la rece. Editura Universităţii “Lucian Blaga”, Sibiu, 2005. |
| | Neagu, C., Vlase, A., Marinescu, N. I. Presarea volumică la rece a pieselor cu filet şi dantură. Editura Tehnică, Bucureşti, 1994. |
| | Ghionea, I.G., Proiectarea asistată în CATIA v5. Elemente teoretice şi aplicaţii, Editura Bren, Bucureşti, 2007. |
| | Racz, G., Cojocaru, S., Proiectarea maşinilor şi utilajelor. Teoria. , Editura Universităţii „Lucian Blaga” din Sibiu, 2003. |
| | Racz, G., Proiectarea maşinilor şi utilajelor, Editura Universităţii „Lucian Blaga” din Sibiu, 2007. |
| | Turcu, N., Bologa, O. Tehnologia presării materialelor plastice. Editura Universităţii, Sibiu, 1994. |
| | Iclănzan, T. Tehnologia presării şi injectării maselor plastice. Litografia Universităţii Tehnice din Timişoara, 1992. |
| | Şereş, I. Injectarea materialelor termoplastice. Editura Imprimeria de Vest, Oradea, 1996 |
| | Şereş, I. Matriţe de injectat. Editura Imprimeria de Vest, Oradea, 1999 |
| | Gheorghe, I., Gheorghe, R., Vibraţii mecanice, Editura Universităţii “Lucian Blaga”, Sibiu, 2002. |

| | |
|---|---|
| | Sârbu, N., Gheorghe, I., Bercan, N.," Îndrumar de laborator de Mecanică şi Vibraţii mecanice", Editura Universităţii "Lucian Blaga", Sibiu, 1987. |
| | Maties, V. *Mecatronica*. Editura Dacia, Cluj-Napoca, 1998. |
| | Barbu, Şt. – *Ingineria sistemelor mecanice*. Editura Universităţii „Lucian Blaga" Sibiu, 2005. |
| | Bârsan, I. - *Acţionări hidraulice şi pneumatice*, vol. I. Ed. Universităţii Sibiu, 1996. |
| | Fetche, V., *Maşini unelte cu comandă numerică*, Editura ULB Sibiu 2005 |
| | Oprean, C., Kifor, C. V., *Managementul Calităţii*, Sibiu, Editura Universităţii Lucian Blaga din Sibiu, ISBN 973 651 310 6, 2002. |
| | Popescu, I., Duşe, D.M. *Tehnologii moderne de fabricare a maşinilor*, Editura Universităţii din Sibiu, 2003 |
| | Zetu D. ş.a. – *Sisteme flexibile de fabricaţie*. Ed. Junimea, Iaşi, 1998 |
| | Iordache, P. *Senzori şi traductoare electrice*. Vol.2. Universitatea Transilvania, Braşov, 2000 |
| | Tanenbaum, A.S. - Organizarea structurată a calculatoarelor, Ed. Computer Press AGORA, 1999. |
| | Handraluca, V., s.a. – *Roboti*, Ed. Dacia, Cluj-Napoca, 1996. |
| | Munteanu, O., s.a. – *Bazele roboticii. Roboti industriali*, Ed. Lux Libris, Brasov, 1996. |
| | Staretu, I. – *Sisteme de prehensiune*, Ed. Lux Libris, Brasov, 1996 |
| | Dumitraş, C., ş.a. *Ingineria controlului dimensional şi geometric în fabricarea maşinilor*. Bucureşti, Editura Tehnică, 1997. |
| | Simion, Carmen, *Toleranţe geometrice. Principii şi metode de verificare*. Editura Universităţii "Lucian Blaga" din Sibiu, 2006. |
| 9.2. Additional Bibliography | Oprean, C., (coordonator) Metode şi tehnici ale cunoaşterii ştiinţifice. Editura Universităţii "Lucian Blaga", Sibiu, 2006 |
| | Catia v5 – documentaţie de firmă, Dassault Systemes, 2017-2021 |
| | Manualul inginerului mecanic, Editura Tehnică. Bucuresti, 1994. |
| | Norme de protectia muncii |
| | |
| | |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

This is achieved through regular discussions in formal and informal settings with representatives of the relevant firms.

Design and implementation of activities, research projects with the aim of applying the skills acquired through the study of the subject.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam/Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 0% (minimum 5) | |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 0% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |

| | | | | |
|---|---|---|---|---|
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | 0% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | 100% (minimum 5) | |
| 11.5 Minimum performance standard[29] | | | | 50% minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | Academic Rank, Title, First Name, Last Name | Signature |
|---|---|---|
| **Course Teacher** | Assist. PhD. Eng. Dan Mihai RUSU | |
| **Study Program Coordinator** | | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*

# COURSE SYLLABUS

*Academic year 2024 - 2025*

## 1. Programme Information

| | |
|---|---|
| 1.1. Higher education institution | **Lucian Blaga University of Sibiu** |
| 1.2. Faculty | Faculty of Engineering |
| 1.3. Department | Departament of Machines and Industrial Equipment |
| 1.4. Field of study | Mechatronics and Robotics |
| 1.5. Level of study[1] | Bachelor |
| 1.6. Programme of study/qualification | Mechatronics |

## 2. Course Information

| | | | |
|---|---|---|---|
| 2.1. Name of course | Practice for the elaboration of the diploma project | Code | FING.MEI. MCTEN.809.SO |
| 2.2. Course coordinator | Assist. PhD. eng. Dan Mihai Rusu | | |
| 2.3. Seminar/laboratory coordinator | Assist. PhD. eng. Dan Mihai Rusu | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.4. Year of study[2] | 4 | 2.5. Semester[3] | 8 | 2.6. Evaluation form[4] | C |
| 2.7. Course type[5] | O | 2.8. The formative category of the course[6] | | | S |

## 3. Estimated Total Time

| 3.1. Course Extension within the Curriculum – Number of Hours per Week | | | | | |
|---|---|---|---|---|---|
| 3.1.a. Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e. Other | Total |
| 0 | 0 | 0 | 0 | 0 | **0** |
| 3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum | | | | | |
| 3.2.a. Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e. Other | Total[7] |
| 0 | 0 | 0 | 0 | 60 | **60** |

| **Time Distribution for Individual Study**[8] | **Hours** |
|---|---|
| Learning by using course materials, references and personal notes | 70 |
| Additional learning by using library facilities, electronic databases and on-site information | 60 |
| Preparing seminars/laboratories, homework, portfolios and essays | 60 |
| Tutorial activities[9] | 8 |
| Exams[10] | 6 |
| **3.3. Total Individual Study Hours[11] *(NOSI$_{sem}$)*** | **190** |
| **3.4. Total Hours in the Curriculum (*NOAD$_{sem}$*)** | **60** |
| **3.5. Total Hours per Semester[12] (*NOAD$_{sem}$ + NOSI$_{sem}$*)** | **250** |
| **3.6. No. of Hours/ECTS** | **25** |
| **3.7. Number of credits[13]** | **10** |

**4. Prerequisites (if needed)**

| | |
|---|---|
| 4.1. Courses that must be successfully completed first (from the curriculum)[14] | Subjects studied in the curriculum of the specialization |
| 4.2. Competences | The general competences are mentioned in the discipline descriptions of the specialization |

**5. Conditions** (where applicable)

| | |
|---|---|
| 5.1. For course/lectures[15] | - |
| 5.2. For practical activities (lab/sem/pr/app) [16] | • Active participation in the project development stages;<br>• Complying with the manner and duration of the project;<br>• According to the syllabus, the discipline involves the guidance of the graduate in the elaboration of the stages of the diploma project. |

**6. Specific competencies acquired[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 10 | Credits distribution by competences[19] |
| **6.1. Professional competencies** | PC1 | To familiarize students with the concepts and knowledge related to the primary processes of materials elaboration and processing, plastics processing, machines, and processing systems. | |
| | PC2 | Knowledge of how to interpret technical documents as well as knowledge of the means and procedures for measuring accuracy and quality inspection. | |
| | PC3 | Knowledge of the structure and functioning of the equipment and installations in the economic unit where the technological practice is carried out, current trends, methods research and monitoring methods, specific programs for the design, modeling and optimization of mechatronic systems, etc. | |
| | PC4 | Knowledge of how to adjust, operate, and maintain specific equipment and apparatus, as well as how to draw up technical documentation of organization, of technical services, etc. | |
| | PC5 | Knowledge of the main technologies and technological flows specific to flexible/intelligent manufacturing systems as well as their logistics, planning, and monitoring. | |
| | PC6 | Identifying the stages and technological processes of obtaining products specific to industrial engineering. | |
| **6.2. Transversal competencies** | TC1 | Cultivating creative skills, encouraging flexible thinking. | |
| | TC2 | Ability to tackle and solve complex problems alone or in a team. | |
| | TC3 | Ability to assemble and lead interdisciplinary teams. | |

**7. Course objectives** (resulted from developed competencies)

| | |
|---|---|
| 7.1. Main course objective | • The diploma project is a test of professional development and as such, it must follow a certain content, form, and scientific level.<br>• The topic of the project must contain research, which may be related to problems of companies, firms, organizations, business or fundamental research, laboratory or contract research and so on.<br>• Graduates must prove through the diploma project that they have mastered correctly and at an appropriate level all the theoretical and practical aspects covered in the specialized subjects studied during the degree course. |
| 7.2. Specific course objectives | • The paper must demonstrate advanced scientific knowledge of the topic, contain elements of originality in the development and solution of the topic, as well as ways to validate them scientifically. |

**8. Content**

| **8.1 Lectures**[20] | | **Teaching methods**[21] | **Hours** |
|---|---|---|---|
| Lecture 1 | | | |
| Lecture 2 | | | |
| Lecture 3 | | | |
| Lecture 4 | | | |
| Lecture 5 | | | |
| Lecture 6 | | | |
| Lecture 7 | | | |
| Lecture 8 | | | |
| Lecture 9 | | | |
| Lecture 10 | | | |
| Lecture 11 | | | |
| Lecture 12 | | | |
| Lecture 13 | | | |
| Lecture 14 | | | |
| | | **Total lecture hours:** | |

**8.2 Practical activities**

| **8.2.a. Seminar** | | **Teaching methods**[22] | **Hours** |
|---|---|---|---|
| Seminar 1 | | | |
| Seminar 2 | | | |
| Seminar 3 | | | |
| Seminar 4 | | | |
| Seminar 5 | | | |
| Seminar 6 | | | |
| Seminar 7 | | | |
| Seminar 8 | | | |
| Seminar 9 | | | |
| Seminar 10 | | | |

| | | | |
|---|---|---|---|
| Seminar 11 | | | |
| Seminar 12 | | | |
| Seminar 13 | | | |
| Seminar 14 | | | |
| | | **Total seminar hours:** | |

| **8.2.b. Laboratory** | | **Teaching methods**[23] | **Hours** |
|---|---|---|---|
| Laboratory 1 | … | | |
| Laboratory 2 | … | | |
| Laboratory 3 | | | |
| Laboratory 4 | | | |
| Laboratory 5 | | | |
| Laboratory 6 | | | |
| Laboratory 7 | | | |
| Laboratory 8 | | | |
| Laboratory 9 | | | |
| Laboratory 10 | | | |
| Laboratory 11 | | | |
| Laboratory 12 | | | |
| Laboratory 13 | | | |
| Laboratory 14 | | | |
| | | **Total laboratory hours:** | |

| **8.2.c. Project** | | **Teaching methods**[24] | **Hours** |
|---|---|---|---|
| Project 1 | | | |
| Project 2 | | | |
| Project 3 | | | |
| Project 4 | | | |
| Project 5 | | | |
| Project 6 | | | |
| Project 7 | | | |
| Project 8 | | | |
| Project 9 | | | |
| Project 10 | | | |
| Project 11 | | | |
| Project 12 | | | |
| Project 13 | | | |
| Project 14 | | | |
| | | **Total project hours:** | |

| **8.2.d. Other practical activities** | | **Teaching methods** | **Hours** |
|---|---|---|---|
| Act.1 | Setting the theme: Graduates of the Mechatronics specialization must be able to conceive, design, operate, monitor, maintain, and troubleshoot products and production systems. To this end, the specific topics involve: | | |

| | | | |
|---|---|---|---|
| | - The study of construction and design principles of mechatronic systems;<br>- Study, knowledge and design of the electrical and electronic systems of the mechatronic systems component;<br>- Study, knowledge and assisted design of hardware and software solutions for the control and microcontroller control of mechatronic systems;<br>- Study and knowledge of the principles of automatic systems and the basics of machine intelligence;<br>- Computer-aided design (2D - AutoCAD and 3D - CATIA, ProEngineering, LifeMode-Adams) of mechanical and mechatronic systems;<br>- Implementation, use, and programming of numerically controlled MU and robots;<br>- Use of programming languages (C, MATLAB, LabVIEW) in research and development of mechatronic systems;<br>- Modeling and simulation of machine and production systems with applications in industry;<br>- Ergonomics, reliability, and maintenance of mechatronic systems; | Lectures, conversation, consultations, working with books, textbooks, databases, etc., independent reading, individual work | 4 |
| Act.2 | Overview of the theme - why it was chosen and its importance. | Data collection, fieldwork, etc.; application of quantitative and qualitative methods of data analysis | 3 |
| Act.3 | Discussion of the research plan: structure, preliminary bibliography as a result of the literature review. | -""- | 3 |
| Act.4 | Developing the research methodology to achieve the proposed objectives. | -""- | 2 |
| Act.5 | The current state of play, with conclusions guiding the studies and research of the paper. | -""- | 6 |
| Act.6 | Content of the paper: studies, relations used, calculations, models, and research. | Discussions with graduates on theoretical and methodological issues specific to each problem addressed in the paper. | 5 |
| Act.7 | Content of the paper: designing experiments, conducting experiments. | -""- | 5 |
| Act.8 | The content of the paper: collection-acquisition of results, analysis of results and conclusions. | -""- | 5 |
| Act.9 | Work content: design of products, technologies and equipment, etc. | -""- | 5 |
| Act.10 | General results. General conclusions. | -""- | 4 |
| Act.11 | Making drawings, graphics, software, etc. (I) | -""- | 5 |
| Act.12 | Making drawings, graphics, software, etc. (II) | -""- | 5 |
| Act.13 | Preparing the presentation for the public presentation of the diploma project. | -""- | 6 |
| Act.14 | Making the presentation electronically. | -""- | 2 |
| | | **Total other practical activities hours:** | 60 |

**9. Bibliography**

| | |
|---|---|
| 9.1. Recommended Bibliography | Telea, D., Popp, I., Masini, echipamente si strategii in SFP, Ed. Univ. L.Blaga, Sibiu, 2015 |
| | Hurgoiu, D. Tehnici de achizitie si prelucrare a datelor, Cluj-Napoca, 2004 |
| | Hurgoiu, D. monitorizarea si controlul proceselor de fabricatie, Ed. AGIR, Buc., 2013 |
| | Dolga V., - Sisteme de achizitii de date, interfete si instrumentatie virtuala, Politehnica Timisoara, 2008. |
| | OLEKSIK, V., PASCU, A. *Proiectarea optimală a maşinilor şi utilajelor,* Editura Universităţii „Lucian Blaga" din Sibiu, 2007. |
| | PASCU, A., OLEKSIK, V. Calculul structurilor utilizând metoda elementului finit, Editura Universităţii „Lucian Blaga" din Sibiu, Sibiu, 2014. |
| | Bologa, O., Turcu, N. Deformarea volumică rotativă la rece. Editura Universităţii "Lucian Blaga", Sibiu, 2005. |
| | Neagu, C., Vlase, A., Marinescu, N. I. Presarea volumică la rece a pieselor cu filet şi dantură. Editura Tehnică, Bucureşti, 1994. |
| | Ghionea, I.G., Proiectarea asistată în CATIA v5. Elemente teoretice şi aplicaţii, Editura Bren, Bucureşti, 2007. |
| | Racz, G., Cojocaru, S., Proiectarea maşinilor şi utilajelor. Teoria. , Editura Universităţii „Lucian Blaga" din Sibiu, 2003. |
| | Racz, G., Proiectarea maşinilor şi utilajelor, Editura Universităţii „Lucian Blaga" din Sibiu, 2007. |
| | Turcu, N., Bologa, O. Tehnologia presării materialelor plastice. Editura Universităţii, Sibiu, 1994. |
| | Iclănzan, T. Tehnologia presării şi injectării maselor plastice. Litografia Universităţii Tehnice din Timişoara, 1992. |
| | Şereş, I. Injectarea materialelor termoplastice. Editura Imprimeria de Vest, Oradea, 1996 |
| | Şereş, I. Matriţe de injectat. Editura Imprimeria de Vest, Oradea, 1999 |
| | Gheorghe, I., Gheorghe, R., Vibraţii mecanice, Editura Universităţii "Lucian Blaga", Sibiu, 2002. |
| | Sârbu, N., Gheorghe, I., Bercan, N.," Îndrumar de laborator de Mecanică şi Vibraţii mecanice", Editura Universităţii "Lucian Blaga", Sibiu, 1987. |
| | Maties, V. *Mecatronica*. Editura Dacia, Cluj-Napoca, 1998. |
| | Barbu, Şt. – *Ingineria sistemelor mecanice*. Editura Universităţii „Lucian Blaga" Sibiu, 2005. |
| | Bârsan, I. - *Acţionări hidraulice şi pneumatice*, vol. I. Ed. Universităţii Sibiu, 1996. |
| | Fetche, V., *Maşini unelte cu comandă numerică*, Editura ULB Sibiu 2005 |
| | Oprean, C., Kifor, C. V., *Managementul Calităţii*, Sibiu, Editura Universităţii Lucian Blaga din Sibiu, ISBN 973 651 310 6, 2002. |
| | Popescu, I., Duşe, D.M. *Tehnologii moderne de fabricare a maşinilor*, Editura Universităţii din Sibiu, 2003 |
| | Zetu D. ş.a. – *Sisteme flexibile de fabricaţie*. Ed. Junimea, Iaşi, 1998 |
| | Iordache, P. *Senzori şi traductoare electrice*. Vol.2. Universitatea Transilvania, Braşov, 2000 |
| | Tanenbaum, A.S. - Organizarea structurată a calculatoarelor, Ed. Computer Press AGORA, 1999. |
| | Handraluca, V., s.a. – *Roboti*, Ed. Dacia, Cluj-Napoca, 1996. |
| | Munteanu, O., s.a. – *Bazele roboticii. Roboti industriali*, Ed. Lux Libris, Brasov, 1996. |
| | Staretu, I. – *Sisteme de prehensiune*, Ed. Lux Libris, Brasov, 1996 |
| | Dumitraş, C., ş.a. *Ingineria controlului dimensional şi geometric în fabricarea maşinilor*. Bucureşti, Editura Tehnică, 1997. |
| | Simion, Carmen, *Toleranţe geometrice. Principii şi metode de verificare*. Editura Universităţii "Lucian Blaga" din Sibiu, 2006. |
| | Catia v5 – documentaţie de firmă, Dassault Systemes, 2017-2021 |

| | |
|---|---|
| 9.2. Additional Bibliography | Manualul inginerului mecanic, Editura Tehnică. Bucuresti, 1994. |
| | Norme de protecția muncii |
| | Catia v5 – documentaţie de firmă, Dassault Systemes, 2017-2021 |

**10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[25]**

This is achieved through regular discussions in formal and informal settings with representatives of the relevant firms and companies.

Design and implementation of activities, research projects with the aim of applying the skills acquired through the study of the subject.

**11. Evaluation**

| Activity Type | 11.1 Evaluation Criteria | 11.2 Evaluation Methods | | 11.3 Percentage in the Final Grade | Obs.[26] |
|---|---|---|---|---|---|
| 11.4a Exam/Colloquy | • Theoretical and practical knowledge acquired (quantity, correctness, accuracy) | Tests during the semester[27]: | 0% | 100% (minimum 5) | |
| | | Homework: | 0% | | |
| | | Other activities[28]: | 0% | | |
| | | Final evaluation: | 0% (min. 5) | | |
| 11.4b Seminar | • Frequency/relevance of participation or responses | Evidence of participation, portfolio of papers (reports, scientific summaries) | | 0% (minimum 5) | |
| 11.4c Laboratory | • Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results | • Written questionnaire<br>• Oral response<br>• Laboratory notebook, experimental works, reports, etc.<br>• Practical demonstration | | 0% (minimum 5) | |
| 11.4d Project | • The quality of the project, the correctness of the project documentation, the appropriate justification of the chosen solutions | • Self-evaluation, project presentation<br>• Critical evaluation of a project | | 0% (minimum 5) | |
| 11.5 Minimum performance standard[29]<br>• Attendance at all scheduled diploma project preparation activities;<br>• Correct and complete preparation of the work according to the methodological rules for the preparation of a diploma project.<br>• The work corresponds to the writing requirements.<br>• Theoretical concepts are presented on the basis of correctly cited specialized literature.<br>• The collection, analysis and interpretation of empirical data has been carried out using a correct and appropriate methodology.<br>• The conclusions of the project are logical and relevant to the topic. | | | | | 50% minim 5 |

***The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.***

Filling Date: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Department Acceptance Date: |_3_|_0_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

| | **Academic Rank, Title, First Name, Last Name** | **Signature** |
|---|---|---|
| **Course Teacher** | Assist. PhD. Eng. Dan Mihai RUSU | |
| **Study Program Coordinator** | | |
| **Head of Department** | Assoc. prof. PhD Claudia Gîrjob | |

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- $C_C$/$C_A$ = Course coefficients / applications calculated according to the table

| **Coefficients** | **Course** | **Applications (S/L/P)** |
|---|---|---|
| Bachelor | 2 | 1 |
| Master | 2,5 | 1,5 |
| Bachelor - foreign language | 2,5 | 1,25 |

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Discussions, debates, presentations and/or analyses of papers, solving exercises and problems*
[23] *Practical demonstration, exercise, experiment*
[24] *Case study, demonstration, exercise, error analysis, etc.*
[25] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[26] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[27] *The number of tests and the weeks in which they will be taken will be specified*
[28] *Scientific circles, professional competitions, etc.*
[29] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*